Heating Piping & Air Conditioning

MARCH 1957

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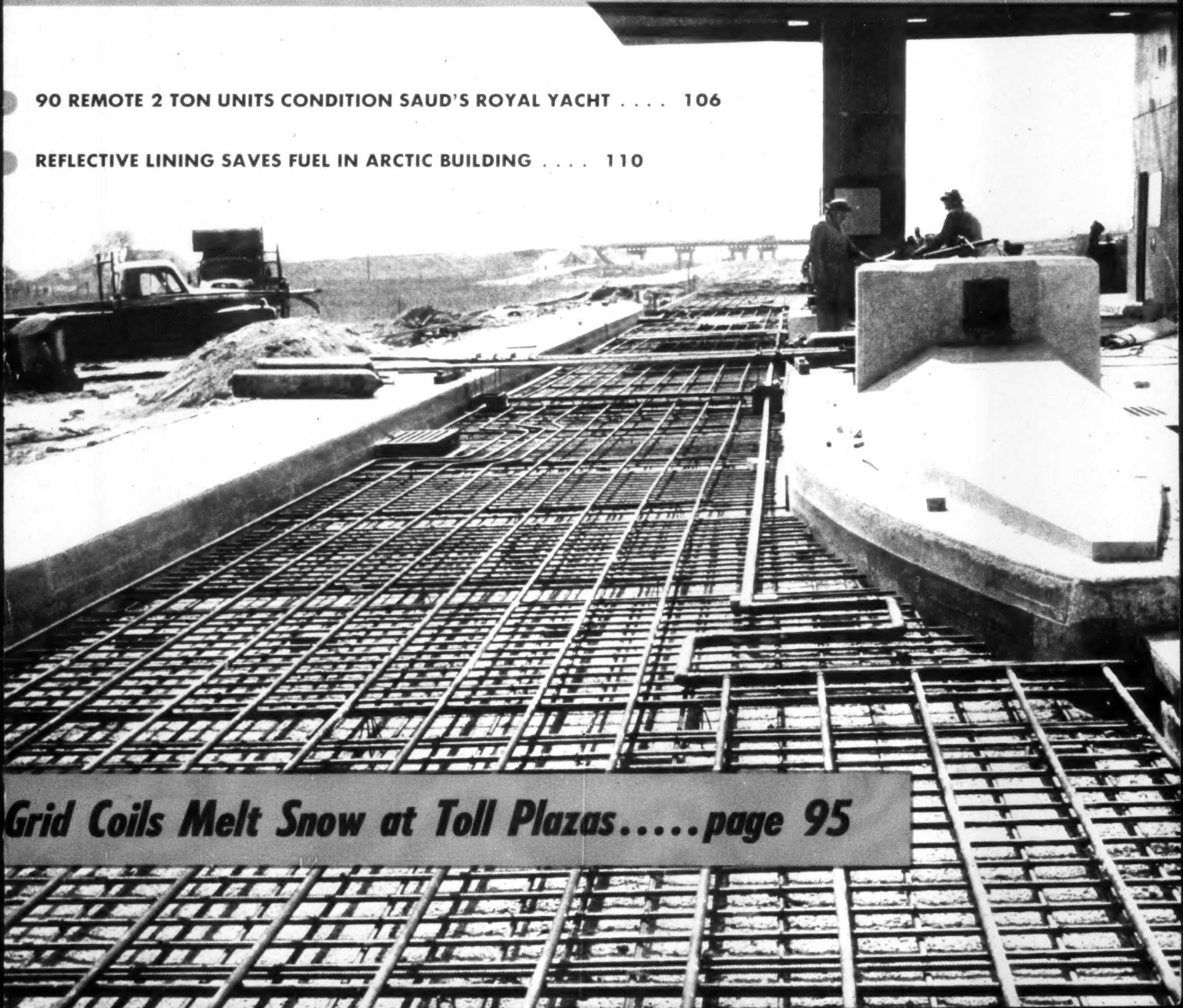
INDUSTRIAL • COMMERCIAL • INSTITUTIONAL • PUBLIC BUILDINGS

Journal Section of the American Society of Heating and Air-Conditioning Engineers—p. 137

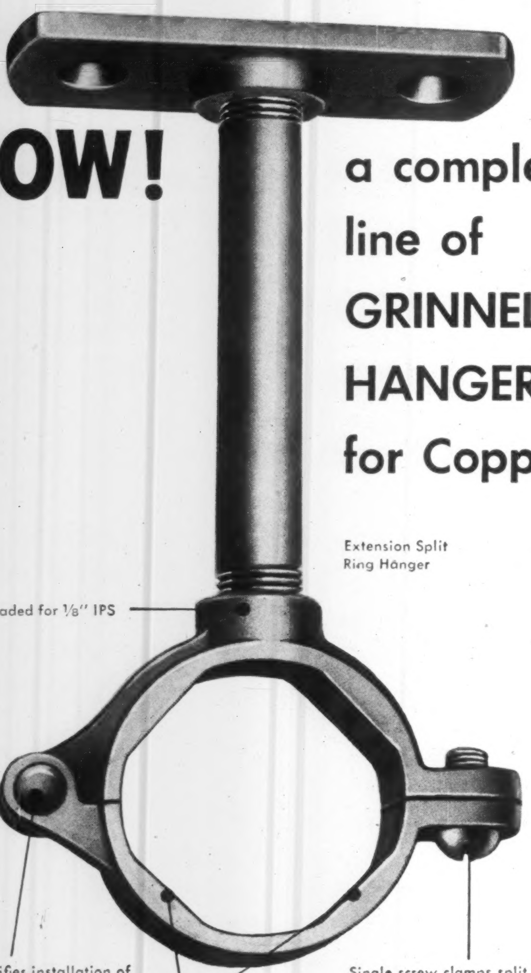


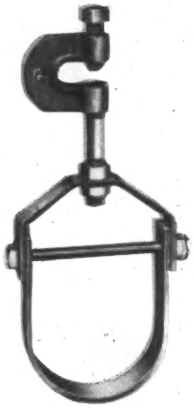
90 REMOTE 2 TON UNITS CONDITION SAUD'S ROYAL YACHT 106

REFLECTIVE LINING SAVES FUEL IN ARCTIC BUILDING 110

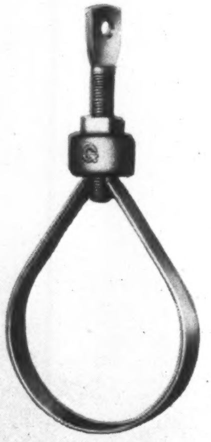
Grid Coils Melt Snow at Toll Plazas.....page 95

NOW! a complete line of GRINNELL HANGERS for Copper Tubing


Extension Split Ring Hanger
Threaded for 1/8" IPS
Hinge simplifies installation of tubing; lower half cannot be mislaid.
Single screw clamps split ring securely to tubing
Four flats provide a positive clamping action

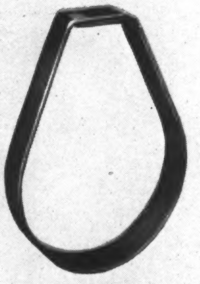


Adj. Wrought Clevis Hanger with Threaded Rod and C-Clamp



Adj. Wrought Ring Hanger

Split-Ring with Socket and Coach Screw



Adj. Wrought Band Hanger

Grinnell now offers, in one *complete* line, every standard type of hanger and support for copper tubing. All are heavily copper plated for long, rugged wear. All are accurately sized to fit standard copper tubing, and designed to give a neater installation wherever copper tubing is used.

For dependability, speed, and convenience . . . let Grinnell's coast-to-coast network of warehouses and jobbers serve you as a one-stop source for all your copper tubing hanger requirements. Grinnell-trained personnel are ready to work with you "on-the-job", anywhere, to help solve any problem connected with hangers and supports for copper tubing.

Whether it be for copper tubing or standard pipe, specify Grinnell hangers. No other company makes as complete a line; provides as thorough a distribution service; or can cooperate as fully on *all* your piping assignments.

Write for your copy of the COPPER TUBING HANGER Catalog.
Grinnell Company, Inc.,
272 West Exchange St.,
Providence, Rhode Island.

GRINNELL

AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

Grinnell Company, Inc., Providence, Rhode Island • **Coast-to-Coast Network of Branch Warehouses and Distributors**

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
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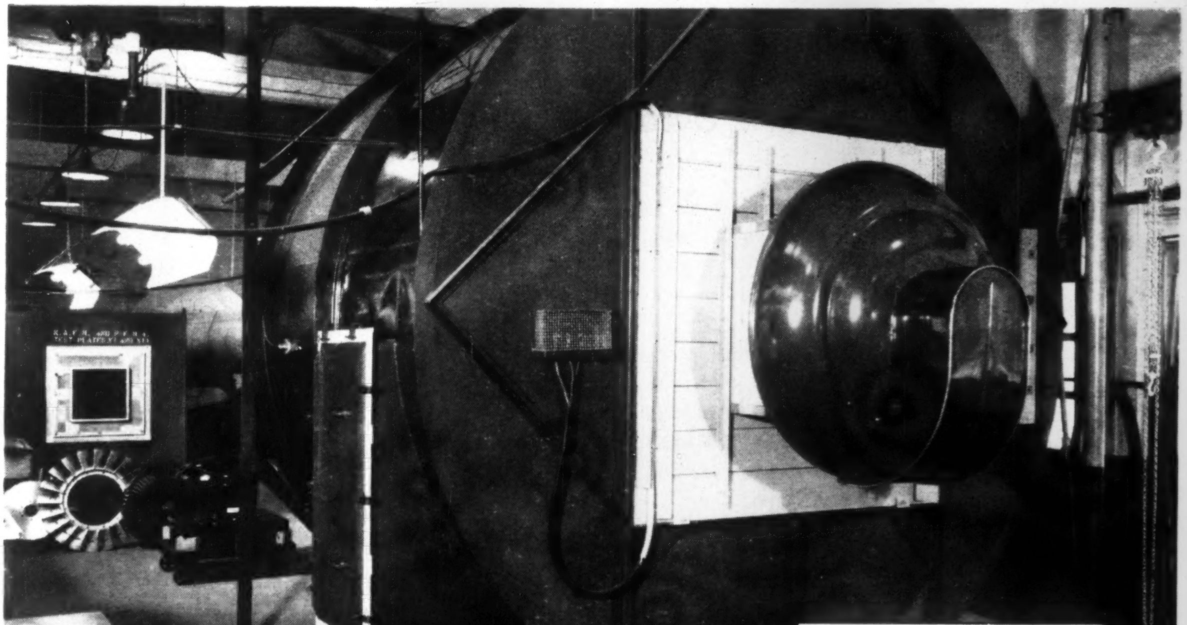
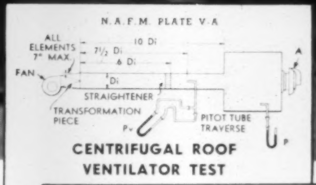
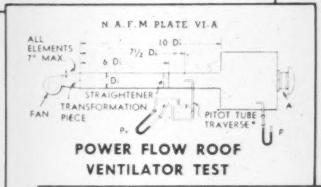
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems




N.A.F.M. PLATE V-A
ALL ELEMENTS 7° MAX.
10 Di
7½ Di
6 Di
Di
FAN
STRAIGHTENER
TRANSFORMATION PIECE
Pv
PITOT TUBE TRAVERSE
A
P

CENTRIFUGAL ROOF VENTILATOR TEST


N.A.F.M. PLATE VI-A
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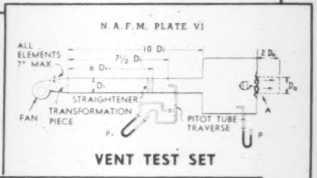
POWER FLOW ROOF VENTILATOR TEST


N.A.F.M. PLATE VI
ALL ELEMENTS 7° MAX.
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7½ Di
6 Di
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2 Do
Do
STRAIGHTENER
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TRANSFORMATION PIECE
Pv
PITOT TUBE TRAVERSE
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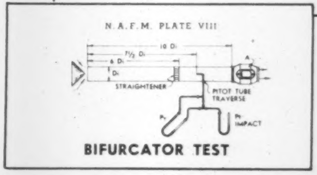
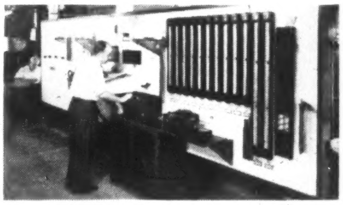
VENT TEST SET


N.A.F.M. PLATE VIII
10 Di
7½ Di
6 Di
Di
A
STRAIGHTENER
PITOT TUBE TRAVERSE
Pv
Pt IMPACT

BIFURCATOR TEST

DeBothezat cfm ratings are CERTIFIED ... no guesswork when you select fans



Here's why you can select a DeBothezat fan by its exact catalog rating — without making any allowance "to be on the safe side." Thanks to DeBothezat's advanced testing facilities, all cfm ratings are *certified*. Right in the DeBothezat plant, accurate wind tunnel tests are made in accordance with the appropriate NAFM plate . . . and conform to U. S. Dept. of Commerce standard 178-51. So a DeBothezat rating is what the complete fan unit actually puts out. Send for Free 8-page bulletin entitled: "Certified Air Moving Equipment." Address Department HP-357.

De Bothezat FANS

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American Machine and Metals, Inc.

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"Boy, that ASHAE Show sure opened a lot of eyes...mine included

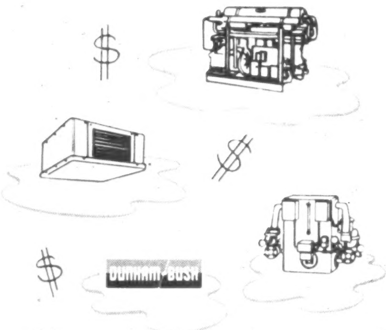
When I got a look at the one complete air conditioning and heating line this consolidated Dunham-Bush outfit is offering, I was "sold". One source—one responsibility makes a lot of sense to me.

Sure I'm tired . . . but not too tired to do some profit planning with this Dunham-Bush line".

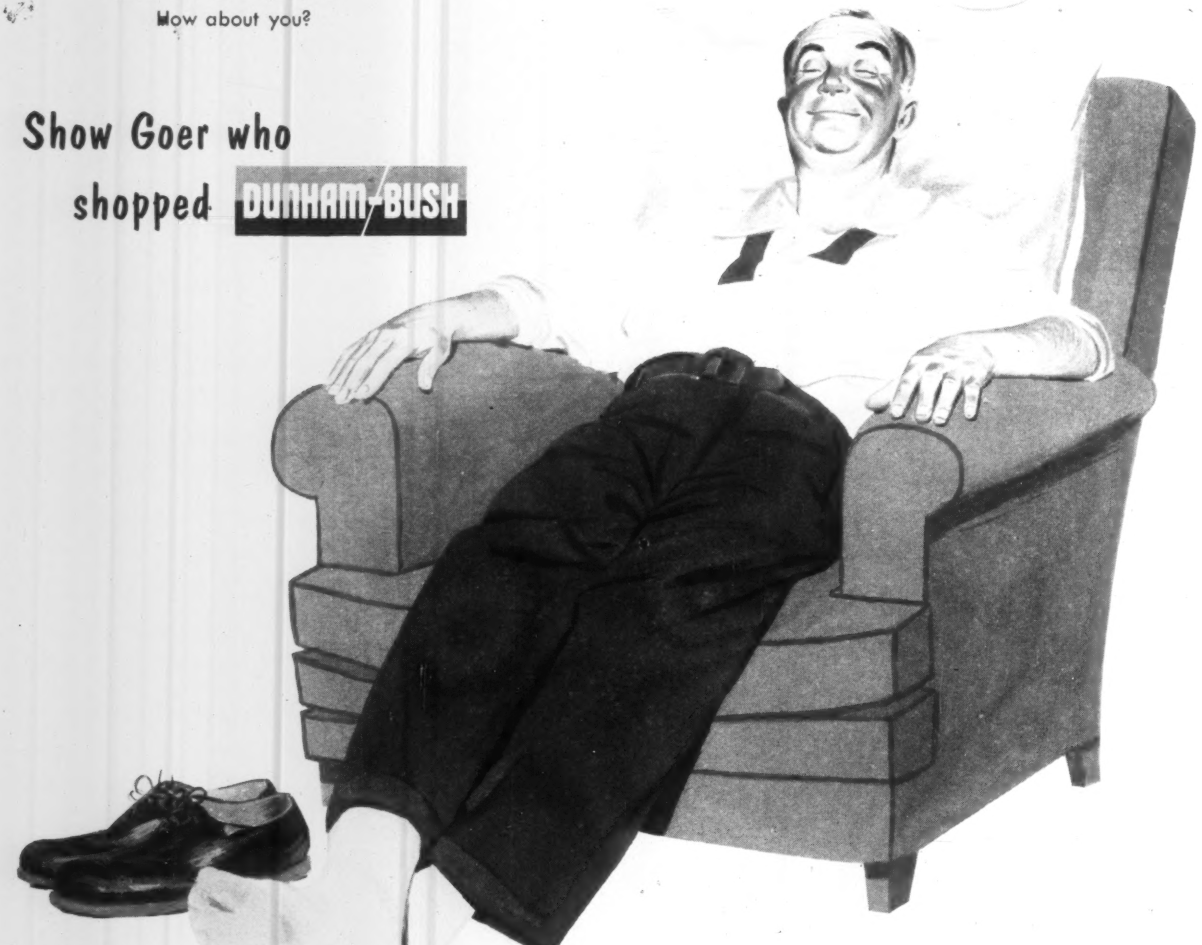
That's the type of talk you heard at the Show, are going to continue to hear.

Dunham-Bush one complete line . . . "close-to-source" supply for faster delivery, lower freight rates . . . expanded engineering and research facilities . . . one source—one responsibility . . . *makes a lot of sense to a lot of people.*

How about you?



Show Goer who shopped DUNHAM-BUSH



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Vol. 29 No. 3

MARCH 1957

(With which is merged the Aerologist)

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Published monthly by the Keeney Publishing Co., 6 N. Michigan Ave., Chicago 2, Ill. Telephone: STate 2-6916. Subscriptions: U.S. and possessions, $3.00 per year; Canada, Cuba, Mexico, Central America, South America, $4.00 per year; other, $6.00. Current copies, U.S. and possessions, 35c each; back copies, 60c each. January 1957 $1.50 per copy. For change of address, notify publisher and your local postoffice of both old and new addresses by the 8th of the preceding month. Member Audit Bureau of Circulations, Associated Business Publications, Inc., and Magazine Publishers Association, Inc. Heating, Piping & Air Conditioning is indexed regularly by Engineering Index, Inc., and Industrial Arts Index and is microfilmed by University Microfilms.

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Entered as Second Class Matter May 18, 1929, at the Post Office at Chicago, Ill. U.S.A. under the Act of March 3, 1879. Additional entry at Mendota, Ill.

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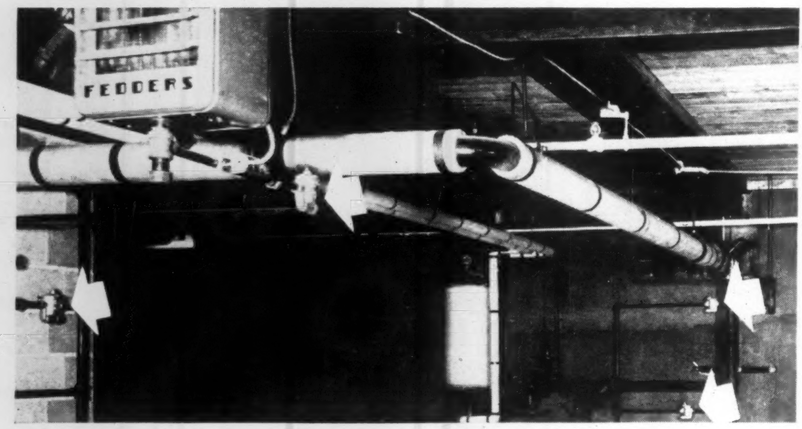
How One Company Has Saved $80,000 to Date by Buying 600 Steam Traps



Armstrong built-in strainer traps save maintenance as well as fuel at L. G. Balfour Co., Attleboro, Mass.

Joseph Brooks, Production Manager at Balfour, insists on "Armstrongs – *no substitute.*"

Armstrong Traps on Low Pressure, Vacuum Return Heating System Cut Fuel Costs $8,000 Per Year, Have Served 10 Years Without Repairs

YOU'D HAVE TO SELL a lot of fraternity pins to come out with $80,000 profit. But, that's the dollar-saving a couple of alert plant men have made by installing Armstrong steam traps at L. G. Balfour Company, fraternity jewelry makers of Attleboro, Mass. And, they've made their own jobs easier by doing it.

Just 10 years ago, Joseph Brooks, Production Manager, and C. J. Ripley, Maintenance Superintendent, installed the first Armstrong traps on their low pressure vacuum return heating system. Now they have 600 in use throughout the plant. The results have been an engineer's dream:

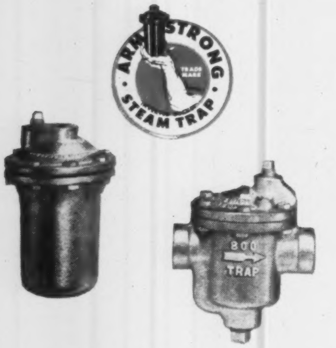
1. **Fuel costs reduced $8,000 annually** despite doubling of the factory's size and increased prices of coal.

2. **One boiler did work of two** after trap installation in original plant. Steam pressure was reduced from 50-75 lbs. to 22-27 lbs. Pressure is reduced to 4 lbs., with 6"-8" vacuum.

3. **No trap repairs** except cleaning in 10 years and no servicing of any kind where strainers were used ahead of traps. Armstrong Y-Type strainers have now been installed ahead of all No. 800 traps and all new traps are No. 880's with built-in strainer (costing less to buy and install than separate strainer and trap.)

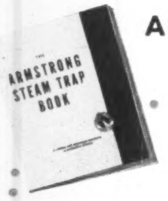
This story of Balfour's $80,000 profit wouldn't be as significant if it were the only one of its kind. But, the frequency of such reports about Armstrong trapping establishes firmly the tremendous cost-reduction opportunities available to many plants throughout the country — perhaps to yours. Isn't it worth looking into?

Your local Armstrong Factory Representative or Distributor will survey your trapping without charge or obligation. Call him or write:



Bottom inlet and side inlet styles for all services.

ARMSTRONG MACHINE WORKS
8743 Maple Street, Three Rivers, Michigan



FREE:
44-page Steam Trap Book —a complete guide to better trapping

ARMSTRONG MACHINE WORKS
8743 Maple St., Three Rivers, Michigan

Please send me a "Steam Trap Book"

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Company______________________________

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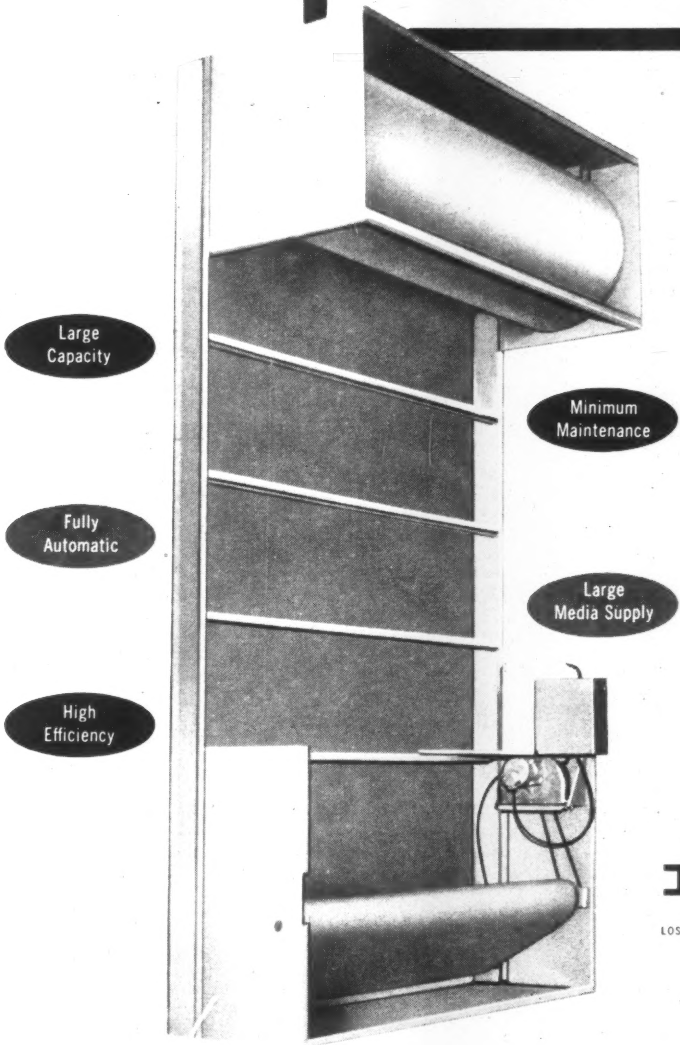
City________________Zone____State________

BRAND NEW!

FAR-AIR®

ROLL-KLEEN

automatic DRY FILTER



Here is a new, modern filter that combines fully automatic operation and high efficiency with large dirt holding capacity and minimum maintenance. Engineered for simplicity of operation, the Roll-Kleen offers dependable performance at low operating cost.

HOW IT WORKS

Glass fiber media with an open mesh cloth backing bonded to the downstream side, passes from the top supply roll, over the filtering area support grid, and onto the takeup roll. A preset rise in filter resistance, indicating dirty media, triggers the takeup roll drive to draw clean media completely over the support grid. This complete change-out assures maximum efficiency at all times.

PERFORMANCE

The Roll-Kleen is designed to operate at 350 to 520 fpm face velocity. Efficiency on Standardized Fine Air Cleaner Test Dust is 85% at 520 fpm and 80+% at 350 fpm.

MAINTENANCE

Other than occasional visual inspections, the Roll-Kleen is virtually maintenance-free. Warning lights (which may be located anywhere in your plant) tell when the media is dirt-loaded as well as when the media roll needs replacing.

CONSTRUCTION

Made of the finest quality components, the Roll-Kleen is available in standard widths of 3, 4 and 5 ft. and heights from 5 ft. to 15 ft. Units may be joined together to meet any CFM requirement.

Write for complete catalog information.

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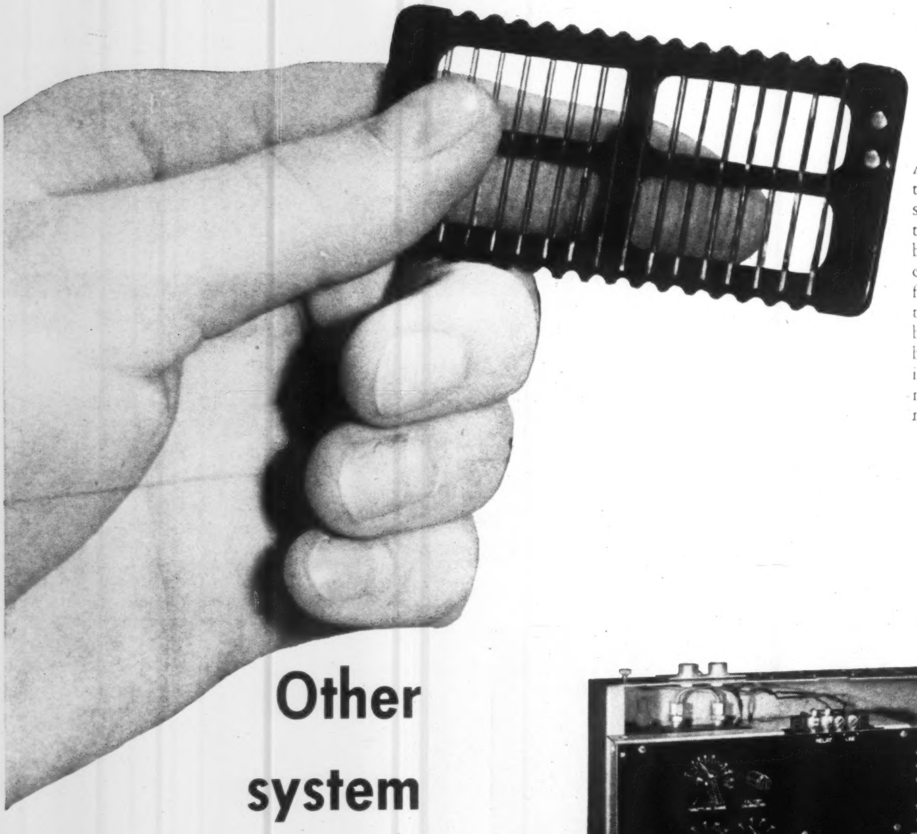
Originators of **FAR-AIR** *Certified Filter Service*

Control leadership through advanced engineering—research

HONEYWELL ELECTRONIC CONTROL

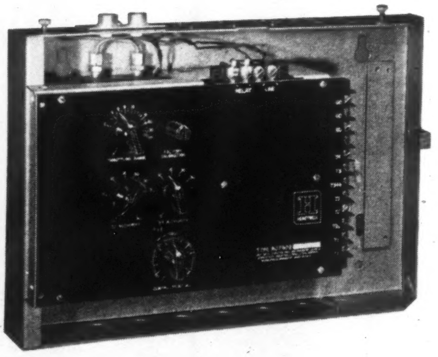
Electronic thermostat



Sensing element—strand of fine wire

A change in temperature changes the resistance of wire wound on a spool—the heart of an electronic thermostat. On this principle is based the simplest and most efficient form of temperature control for buildings—Honeywell Electronic. The sensing element can be fitted to any application. It can be strung the width of a duct, or it can be tightly coiled. It need not be accessible because adjustments can be made remotely.

Other system components



Electro-Pneumatic Relay—RO7900

This unit in conjunction with its electronic thermostats fulfills the function of pneumatic thermostats and puts out a control air pressure from an electronic sensing signal for use in a normal pneumatic control system. The RO7900 brings electronic convenience, sensitivity and simplicity to your master-submaster jobs. It ties in the benefits of electronic sensing with your basic pneumatic system. When you replace your pneumatic thermostat with an electronic—and use it with the RO7900—all checking, adjustment and maintenance is done at the panel, eliminating all attention at the thermostat.

–SIMPLE WAY TO DO A BETTER JOB

Gives you flexibility in thermostat location, system functioning—and requires virtually no servicing

When it comes to performance, no other temperature control system comes close to matching the flexibility of Honeywell Electronic.

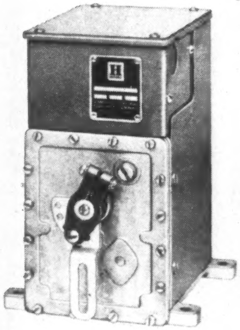
Because the control point and throttling range are unlimited, it is highly adaptable to any building control application.

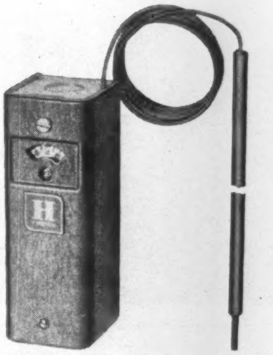
And because it's *electronic* you can easily and inexpensively use additional thermostats for averaging—or for improved stability and accuracy. An example: the three-thermostat team, one in space, one in discharge air or water, one outdoors. And the faster response of electronic thermostats gives better performance for any client. Also, you can easily tie in electronic master control with pneumatic or electric controls.

When it comes to service, the wonderful simplicity of Honeywell electronic controls becomes readily apparent.

Thermostats, because they have no moving parts, give little trouble, need not be accessible. Checking and adjusting is all done remotely, electronically.

For complete information on Honeywell Electronic Controls, call your local Honeywell office. Or write direct to Honeywell, Department AC-3-109, Minneapolis 8, Minnesota.





For another big, exciting Honeywell development in electronics, turn the page.

Electronic Motor—M7021

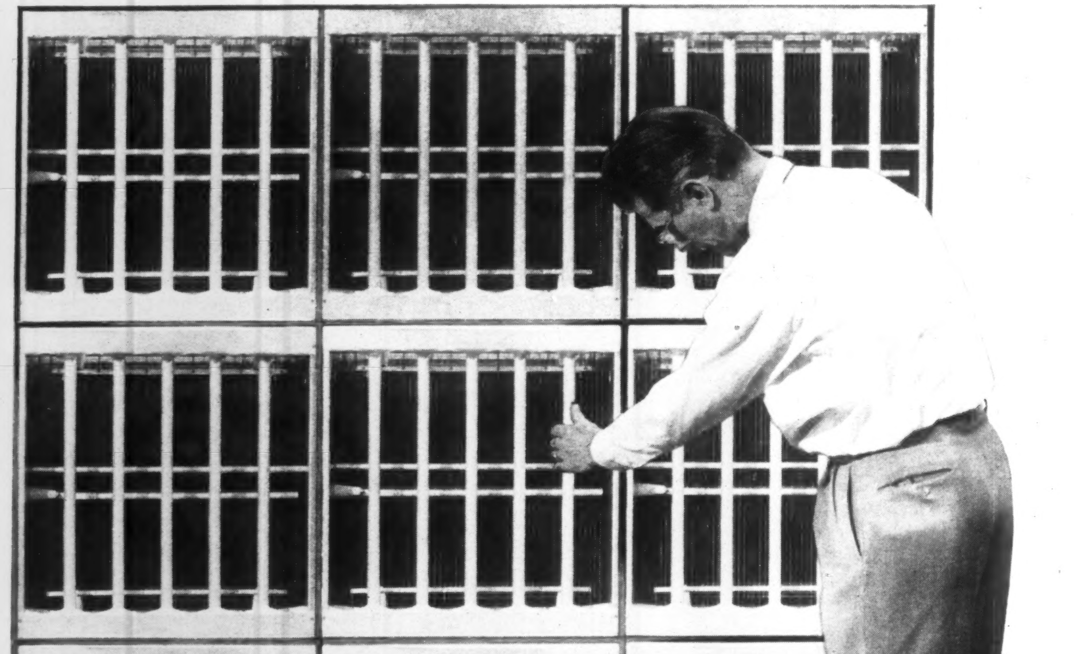
This damper or valve motor gives the advantages of an electronic control system without the necessity for a large control panel. Incorporated in the motor are the normal electronic amplifier and panel. It offers most of the advantages of a large control panel, yet is compact and simple. You have the finest, most stable type of control, you save wiring from panel to motor, save cost of mounting panel, save the space needed by a conventional panel. Installation is very simple and quite economical. And the price is lower than if you were to buy a panel and motor separately.

Two Position Control—L6018

The L6018 is one of a complete line of two-position controls and remote-bulb thermostat controllers for electronic or electric systems. These can be used for many switching functions—like automatic summer-winter changeover of large systems or even individual room conditioners. There are four models of the L6018—A, B, C, D. Each provides a different switching action for various control functions. Together they give an idea of the breadth of the Honeywell line. All controls in this series are low-cost, yet accurate. They are simply built for aiding installation and maintenance.

Control leadership through advanced engineering—research

HONEYWELL ELECTRONIC AIR CLEANER



To aid the engineer, Honeywell makes a complete range of Electronic Air Cleaners for any type of air conditioning or ventilating system. Each installation begins with the single-cell unit [inset]. Number of cells is determined by amount of air handled by the system. The illustration shows the building-block technique employed. *Module construction* makes installing and servicing easy.

–END TO AIRBORNE DIRT PROBLEMS

Now, from the leader in automatic controls for air conditioning comes another progressive step toward ideal control of indoor climate

The electronic Air Cleaner is the most recent addition to Honeywell's world-famous line of products for the control of indoor comfort.

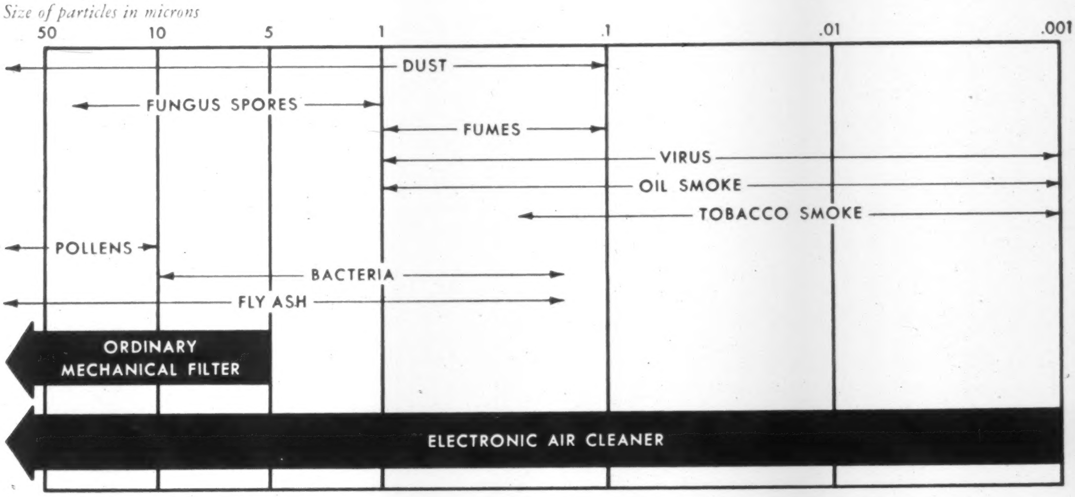
When you install it you assure your clients freedom from the costly scourge of airborne dirt—freedom that ordinary impingement-type filters can never provide.

The superiority of electronic air cleaning is described graphically below, suggesting that a Honeywell Electronic Air Cleaner begins to amortize itself the day it's installed.

And because this is a Honeywell product, you get nation-wide service from reliable field engineers who talk your language.

For complete information on the Honeywell Electronic Air Cleaner, call your local Honeywell office. Or write direct to Department AC-3-109, Minneapolis 8, Minnesota.

Efficiency Comparison of Electronic Air Cleaner and Mechanical Filter

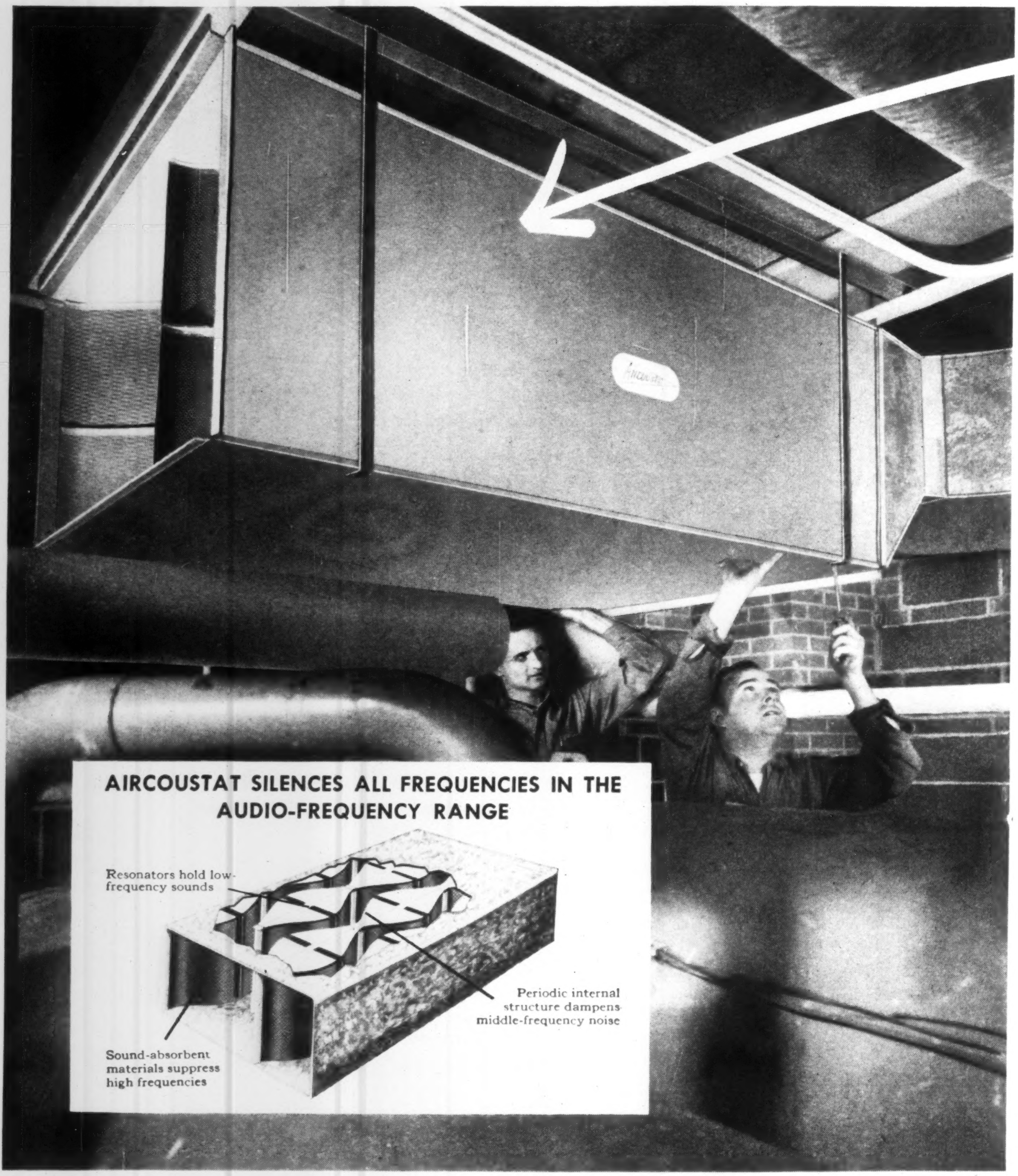


As shown above, common airborne contaminants range in size from beyond 50 to .001 microns. In this area lie dust, pollens, fungus spores, bacteria, fly ash, fumes, oil smoke, virus and tobacco smoke. It should be noted that the ordinary mechanical filter removes very few of the airborne particles of less than 5 microns in size. But notice the wide range of protection offered by the Honeywell Electronic Air Cleaner. Here you get not only the removal of the large coarse particles, but the microscopic ones, as well—a major cause of soiling and many respiratory ills.

Honeywell

H HONEYWELL *First in Controls*

AIRCOUSTAT* sound traps layout for controlling


AIRCOUSTAT SILENCES ALL FREQUENCIES IN THE AUDIO-FREQUENCY RANGE
Resonators hold low-frequency sounds
Periodic internal structure dampens middle-frequency noise
Sound-absorbent materials suppress high frequencies

simplify design and air conditioning noise

THIS 5-FT. AIRCOUSTAT REPLACES 80 FEET OF ORDINARY DUCT LINING

AIRCOUSTAT saves you time on the job because it's pre-engineered . . . and fits acoustically if it fits geometrically. AIRCOUSTAT is quick and easy to install . . . no special tools are required.

Most Efficient Solution

AIRCOUSTAT's power to deaden sound is unmatched by other sound control methods devised for air conditioning systems. Acoustical performance is *guaranteed*. Efficiency is more than 13 times that of ordinary lining. And AIRCOUSTAT provides a lower flow resistance and less pressure drop than other sound control methods.

AIRCOUSTAT suppresses sound in low-velocity air conditioning systems . . . will silence an entire system or selected outlets. AIRCOUSTAT units fit any size of duct within the range of unit sizes . . . adapt themselves to any shape of duct.

Cost You 50% Less

AIRCOUSTAT units cost you as much as 50% less than ordinary duct lining . . . with savings in time and labor costs. AIRCOUSTAT is quick and easy to install . . . no special tools are required. You can ship ducts nested together and store them outside on the job site.

Apply Anywhere

AIRCOUSTAT eliminates noise in a wide range of applications: general and private offices, conference rooms, sleeping quarters, and recording studios.

Born of the Jet Age

Koppers' amazing new AIRCOUSTAT is the product of years of experience in designing sound control installations for aviation and other industries. Jet engine housings, machine enclosures, sound barriers and traps, sound-proof foremen's offices—these are only a few of the many sound control devices created by Koppers Industrial Sound Control engineers. Koppers has put this engineering "know-how" to work silencing air conditioning noises more effectively . . . more economically than was ever before possible . . . saving you time and costs.

For more details, write to KOPPERS COMPANY, INC., Industrial Sound Control Dept., 6203 Scott Street, Baltimore 3, Maryland.

**Koppers Trademark*

KOPPERS

INDUSTRIAL SOUND CONTROL

Engineered Products Sold with Service

Today—Join American Blower's

EVERY
BUSINESS IS A
PROSPECT FOR
NEW
AMERICAN BLOWER
PACKAGED
AIR CONDITIONERS

Modern styling for modern businesses! New 1957 American Blower Packaged Air Conditioners come in sizes for *all* commercial jobs. Every business is a prospect — offices, stores, restaurants, showrooms, small industrial plants. Join American Blower's big sales-maker program now. Profits are assured — you can stake your future on it!

Big Sales-Maker Program!

Sell new 1957 comfort-engineered Packaged Air Conditioners

The franchise with the future! Right now, not next spring or summer, is the right time to step into the wide-open, growing air-conditioning business.

With American Blower, you're backed by one of the most respected names in the industry — a leader in air-handling and conditioning for more than 75 years. You build for the future with the product customers want: the most modern packaged air conditioners on the market.

You have the kind of factory support that assures your success, with power-packed advertising, merchandising aids . . . sales training, warehousing plan — a complete sales-maker program!

Most modern units on the market! 1957 American Blower Packaged Air Conditioners are *all-new*, and tastefully styled to blend with any décor. There are sizes to fit *any* commercial job: 3 ton to 20 ton; install with ductwork or handsome plenum section. And you offer a 5-year factory warranty on the refrigeration circuit — a big American Blower sales-maker!

Thorough sales training! You get a full factory course on how to sell and service modern American Blower Packaged Air Conditioners. You learn the product in and out from skilled American Blower engineers. You learn how to sell them, who to sell them to, how to make installations — a big American Blower sales-maker!

Compelling national ads pave the way! Full-page ads in national magazines, like *The Saturday Evening Post, Newsweek, Business Week,* help to presell your customers for you — a big American Blower sales-maker!

Co-operative advertising plan! You get a complete advertising kit that tells you how to make the most of local advertising; gives you full, step-by-step instructions on preparing your own ads; contains ready-made ad-mat and product reprints; offers radio spot announcements, TV commercials; tells you how to order. And American Blower helps you pay for your advertising — a big American Blower sales-maker!

Colorful sales-promotion material! You get a complete sales package for prospecting by mail and at point of purchase; product-line folders, wall posters, direct-mail pieces, envelope stuffers, sample sales letters, customer brochures — a big American Blower sales-maker!

Hurry — installations are passing you by right now! Forward-looking businessmen are already looking around for air conditioners to beat the spring installation tie-up. So act today! Get in on profits *now* with American Blower's big sales-maker program. Clip and mail coupon for complete details. American Blower Division of American-Standard, Detroit 32, Michigan.

DISTRIBUTORS: There are still choice territories open for aggressive, well-qualified distributors to handle new American Blower Packaged Air Conditioners. Send for franchise data today!

AMERICAN BLOWER

Division of AMERICAN-Standard

AMERICAN-Standard PRODUCTS

THE FRANCHISE WITH THE FUTURE

American Blower
Division of American-Standard
Detroit 32, Michigan

Yes! I am interested in becoming a ☐ dealer ☐ distributor for American Blower Packaged Air Conditioners. Please have your representative call.

Name ______________________

Firm ______________________

Address ______________________

City ______________ Zone ______ State ______

Here's what makes Bronze Valves

TYPICAL OF WALWORTH QUALITY is the union body-to-bonnet connection which stiffens the body against internal pressure; makes taking the valve apart a simple operation and reduces the chances of distortion or leakage even though the valve is repeatedly taken apart and reassembled. With this type of construction there is no possibility of the bonnet coming off the valve while the handwheel is being turned.

1
150
WALWORTH

HEAVY BODY CONSTRUCTION is typical of *all* Walworth Bronze Valves. Extra-thick walls and rugged wrench hexes constitute a high safety factor and prevent distortion while the valve is being installed in the pipeline. Extra-deep pipe threads are accurately machined to eliminate leakage. Walworth Bronze Valves are also available with flanged, silver-brazed or soldered ends in certain sizes and types.

MEET THE CHAMP! The chief engineer of a midwestern plant had used a parade of valves in severe boiler blowdown service. Most didn't last longer than 60 days. None survived 90 days.

On the recommendation of a Walworth Representative the engineer installed the Walworth No. 225P Bronze Globe Valve shown here, stating that he would be entirely satisfied if it lasted a bare three months. Exactly 4 years and 362 days later the valve was taken out of service—not due to the wire drawing, steam cutting and galling which made the other valves short-lived—but because the highly turbulent steam finally wore a small hole in the body.

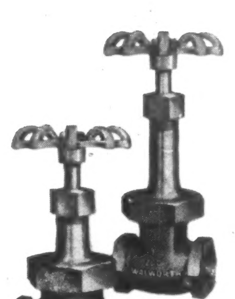
This is the kind of valve satisfaction you get—when you specify and use Walworth Bronze Valves. They are the longest wearing, toughest bronze valves on the market.

Walworth Subsidiaries: ALLOY STEEL PRODUCTS CO. • CONOFLOW CORPORATION • GROVE VALVE AND REGULATOR CO.

Walworth
the real bargain!

EXTRA-LARGE STEMS with extra-long, extra-deep threads prolong valve life, protect against wear and distortion and provide tight positive shutoff. The surface of the stem is machined to a glass-like finish for minimum handwheel effort and to preserve the packing which results in fewer inspections and less maintenance. The top of the stem is tapered and squared to hold the handwheel securely.

TO REDUCE WIRE DRAWING to a minimum, certain types of bronze globe valves have stainless-steel plug-type seats and discs heat-treated to a nominal hardness of 500 Brinell, adding years to valve life even in severe services. These valves can be tightly closed on sand, grit or pipe scale without damage. Seats and discs are machined simultaneously, assuring perfect mating.

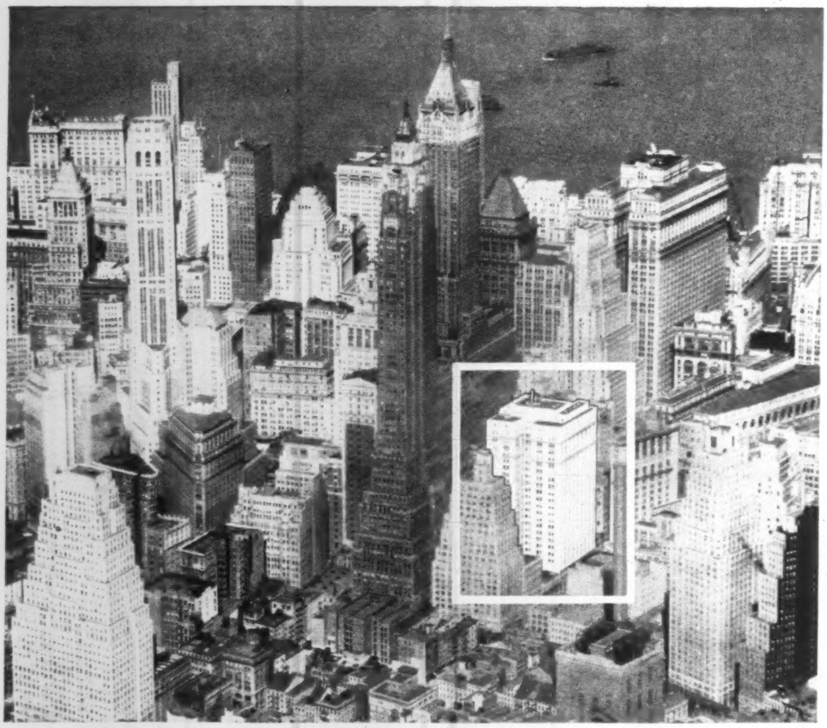


There is a Walworth Bronze Gate, Globe, Angle or Check Valve for every service. Walworth is continually developing new valve types and materials, including plastics, to keep pace with the growing variety and severity of services in modern industry. For full information, see your Walworth Distributor or write:
Walworth, 60 East 42nd Street, New York 17, N. Y.

WALWORTH

Bronze Valves and Fittings

M & H VALVE & FITTINGS CO. • SOUTHWEST FABRICATING AND WELDING CO., INC. • WALWORTH COMPANY OF CANADA, LTD.



26 Story AMERICA FORE Building at 80 Maiden Lane is located in the hub of New York's financial and insurance district. When built in 1912 it was Manhattan's fifth largest office building

Architects for
Building Modernization:
Cross & Son

Mechanical Engineers:
Meyer, Strong & Jones

General Contractor:
Irons & Reynolds

Mechanical Contractor:
Kerby Saunders, Inc.

All of New York City

EIGHTY · MAIDEN · LANE

Today's **80 Maiden Lane Building** represents one of the largest and most complete reconstruction job attempted in New York City. The building has over 250,000 sq. ft. and is occupied by 2,500 people. It is sturdily built, structurally sound and well located.

Modernization of lighting, heating, flooring, corridors, elevators and other facilities was accomplished without serious interruption of normal growth and expanision during the alterations period.

The **H-shaped** building complicated solar-load effects. Changes in heat gain from the sun were caused by traveling shadows. Fast response of Powers Heating-Cooling Thermostats in air conditioning units compensate for this condition.

America Fore
★ INSURANCE GROUP ★

HOME OFFICE

The Continental Insurance Company
Niagara Fire Insurance Company
Fidelity-Phenix Fire Insurance Company
The Fidelity and Casualty Company of New York

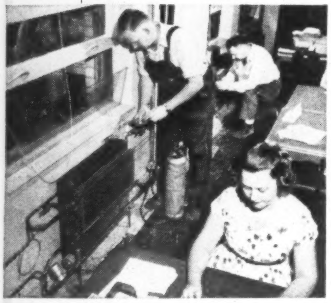
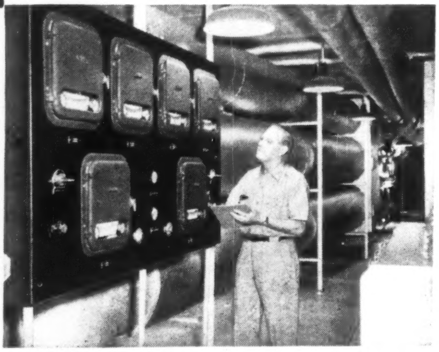


Photo shows installation of air conditioning equipment with minimum of disturbance to office employees.



POWERS Air conditioning control system helped transform this 44 year old structure into a comfortable and efficient office building

Productivity of Employees Was Increased 9.3% and there were also fewer errors in the Transcribing Department and less absenteeism and reduced labor turnover, throughout the organization, resulting from more pleasant surroundings and greater thermal comfort. A 1912-vintage heating system was replaced with modern air conditioning . . . controlled by Powers.

Air conditioning system chosen was a 1350 ton high velocity conduit type for the perimeter of the building and a low pressure system for the interior zones.

Over 1600 air conditioning units in the perimeter of the building are controlled by Powers Heating-Cooling Thermostats operating Packless valves. Primary air to these units is supplied by four air conditioning systems. Interior zones of the building are served by seven air conditioning systems which supply tempered and humidified air in Winter and cooled and de-humidified air in Summer.

Powers sub-master room thermostats or type K return air thermostats control interior zone spaces. These instruments schedule the indoor temperature between 72 and 80° F as the outside air varies between 75 and 95° F. One of the 14 Powers Control Panels with Series 100 Temperature Indicating Controllers is shown below on opposite page.

If You Are Planning a New Building, or modernizing an old one, ask your architect to include a Powers Time-proven Quality System of Control. You will insure utmost comfort and lowest operating and upkeep cost.

For further information contact our nearest office

THE POWERS REGULATOR COMPANY

SKOKIE, ILLINOIS | *Offices in Chief Cities in U.S.A., Canada and Mexico*

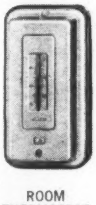
65 YEARS OF AUTOMATIC TEMPERATURE AND HUMIDITY CONTROL

POWERS
FLOWRITE VALVE

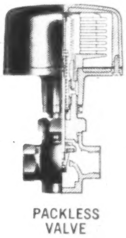
FLOWRITE VALVE

POWERSTROKE MOTORS

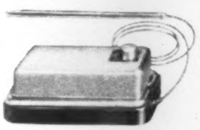
AVAILABLE 3", 4"- 6"



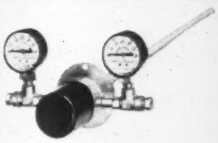
ROOM THERMOSTAT



PACKLESS VALVE



HEATING-COOLING THERMOSTAT

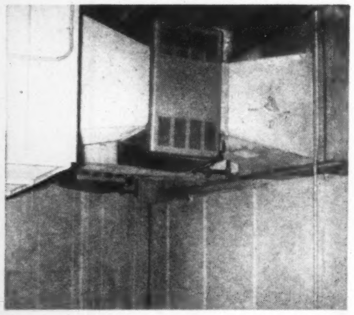


LIMITEM THERMOSTAT

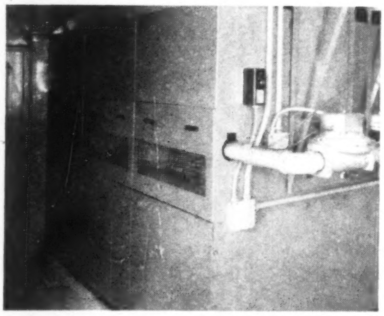
STATIC PRESSURE REGULATOR

(c83)

Stretch Budgets for Church with Janitrol



Heating and cooling for this church is handled by three Janitrol Duct Furnaces, combined with a 60-ton cooling system. Janitrol Duct Furnaces are especially designed for use in combination systems . . . save money by using same blowers and ducts as cooling system.



Unusual quietness in operation wins praise from pastor and congregation for this Janitrol gas-fired central system. Six Janitrol BDC Heavy Duty Gas-Fired Heaters provide 1½ million Btu/hr. input. System is compact, easily accessible, and economical.

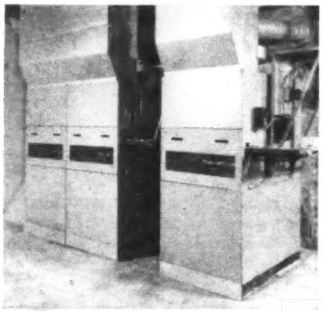
When you are specifying heating or cooling equipment for needs peculiar to churches, it will pay you to know these facts.

Janitrol's complete line of equipment for new construction and modernization includes units for virtually every church heating and cooling requirement . . . with unusual flexibility of installation. Whether the job calls for a compact central system, multiple

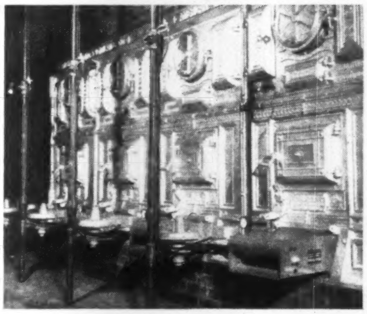
winter conditioners adaptable for summer cooling

. . . with installation of Janitrol's new air-cooled cooling system that uses no water, eliminates water service and maintenance costs. May be installed concurrently with winter conditioner, or any time later, without additional ductwork.

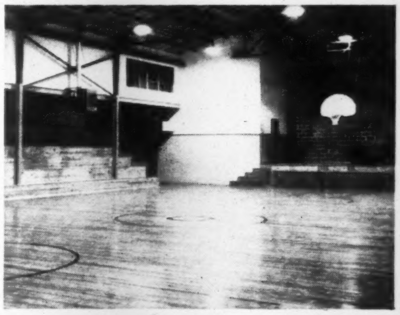
Building and Modernization Heating and Air Conditioning



Separate central systems to heat upstairs and downstairs rooms were installed in this church modernization job. The ultimate in a compact, efficient, automatic installation was achieved with Janitrol gas heating equipment.



If the old heating system is in good shape, conversion to automatic gas heat with Janitrol High Capacity Gas Conversion Burners is often the best answer. They're designed for large capacity systems. This installation uses four Janitrol SC-05 burners.



Janitrol gas unit heaters work independently of central system to heat large gymnasium . . . provide fast, low-cost heating and temperature control required by the varying activities program. Janitrol unit heaters are designed for dual-fuel operation, save floor space, insure low maintenance costs.

units, or a combination of both, Janitrol brings you welcome design freedom!

Purchase costs are well in line, too. And, superbly designed, solidly built Janitrol equipment minimizes installation costs. You can enhance your reputation with Janitrol quality, even on modest budget jobs.

Of course, you want to insure your client's satisfaction for the years to come as well. And thousands of Janitrol installations testify that Janitrol quality means top-level comfort, with important savings in operating and upkeep costs.

Look into Janitrol equipment for your next job. Our engineers will gladly work with you in developing complete specifications. Call your Janitrol office, or write Janitrol Division, Columbus 16, Ohio.

®Janitrol

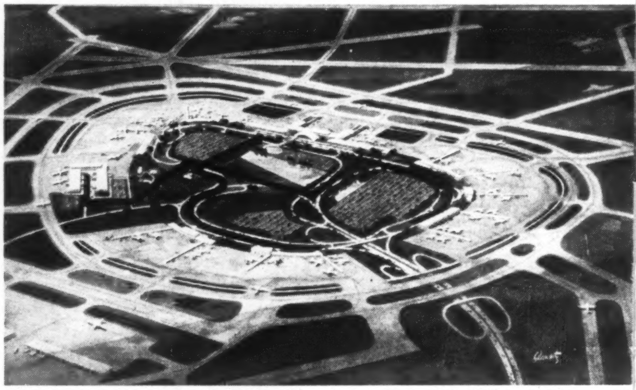
JANITROL HEATING & AIR CONDITIONING DIVISION
SURFACE COMBUSTION CORPORATION
COLUMBUS 16, OHIO
IN CANADA: MOFFAT HEATING & AIR CONDITIONING DIVISION
MOFFATS, LTD., TORONTO 15
Also Makers of *Surface* Industrial Furnaces, *Kathabar* Humidity Conditioning, *Janitrol* Residential Heating and Cooling Equipment.

Architects' and Engineers'
information service

Write today for complete A.I.A. files on heating with gas in big buildings of every type, and for Janitrol specifications service. There's no obligation.

$90,000,000 Idlewild expansion program uses

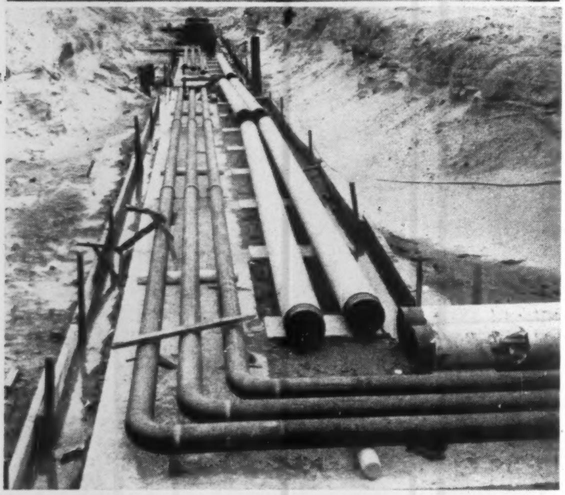
New TERMINAL CITY covers 655 acres. The steel framework for the central heating plant can be seen in the center of this panoramic view. Steam and refrigerated lines run from it to all of the proposed buildings.



Artist's sketch of Terminal City showing proposed buildings and extent of high temperature hot water system.

1.

2.



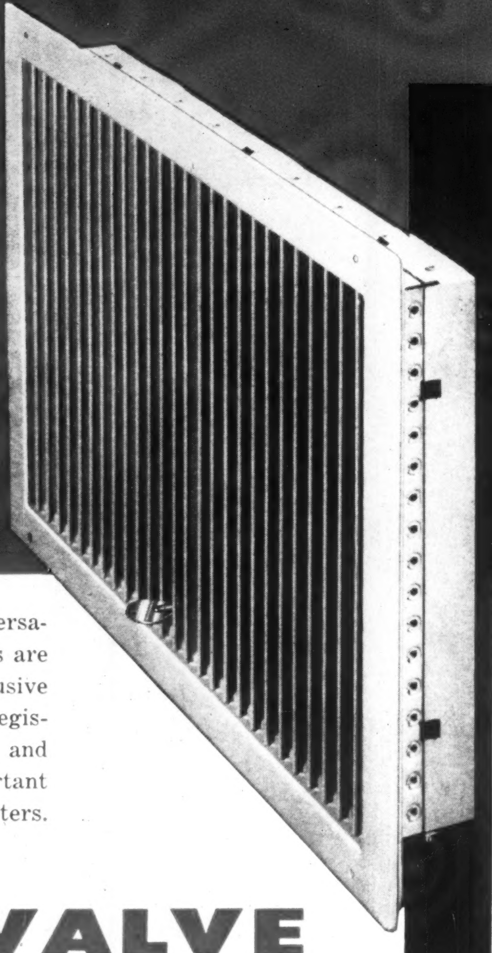
3.

1. LARGE TRENCH shows one expansion loop in foreground and another in background. Note large pipes for chilled water lines running outside of the walled trench containing the high temperature hot water system. The control tower is in the center of the photograph, and the new International Arrival Building is at the right of the tower. The bags of GILSULATE are slid down boards into the trench.

2. 1100-FOOT TRENCH clearly shows the concrete pad on which the hot water pipes are laid (across cement-filled transite supports). The large pipes containing chilled water are insulated with other materials. At a later stage, the hot water system will be walled in by concrete slabs. The ditch is cleaned and drained before GILSULATE is poured.

3. INSPECTOR CHECKS thickness of GILSULATE covering over an expansion loop.

MULTI-TROL
COMMERCIAL REGISTERS
by Air Control
GIVE YOU THIS BIG DIFFERENCE*

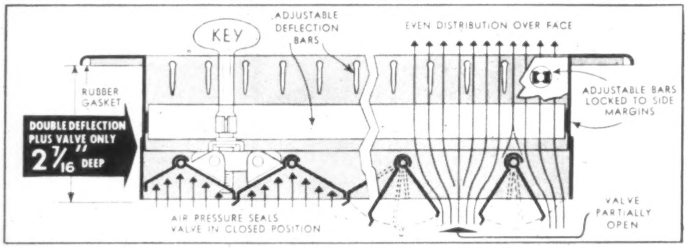


With Multi-Trol commercial registers you get performance and versatility no others can equal. Where ordinary commercial registers are too deep to be used with standard ducts, Air Control's exclusive Shallo-Valve solves the problem. Multi-Trol 4-way deflectional registers with Shallo-Valve can be installed in standard 3¼″ ducts, and still leave ample space for adequate air flow. That's the important difference between Multi-Trol and any other commercial registers.

New * SHALLO-VALVE

EXCLUSIVE WITH MULTI-TROL COMMERCIAL REGISTERS

Multi-Trol Shallo-Valve louvers are the opposed-action type, designed to deliver air evenly over the face of the register at any velocity. When closed, air pressure seals the valve tightly, preventing annoying whistles. Adjustable bars and opposed-action valves provide positive 4-way control of the air stream. The Shallo-Valve of Multi-Trol registers, only 2½″ deep, requires no special duct work in commercial or residential heating-cooling installations.


KEY
ADJUSTABLE DEFLECTION BARS
EVEN DISTRIBUTION OVER FACE
RUBBER GASKET
DOUBLE DEFLECTION PLUS VALVE ONLY 2 7/16″ DEEP
ADJUSTABLE BARS LOCKED TO SIDE MARGINS
AIR PRESSURE SEALS VALVE IN CLOSED POSITION
VALVE PARTIALLY OPEN

Only Multi-Trol commercial registers by Air Control offer you all these advantages:

Key-operated Shallo-Valve — Minimum Air Resistance — Air Foil Contour Face Bars — Modern Styling with smooth, rounded corners — Handsome beige finish. Pivots of adjustable face bars are locked into margin, can't pull out.

Multi-Trol registers and grilles come in a wide range of sizes and styles for every need. See your favorite jobber.

WRITE FOR CATALOG 56-AC
SHOWING THE COMPLETE MULTI-TROL LINE*

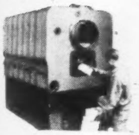
**Patent Pending*

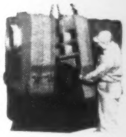
AIR CONTROL PRODUCTS, INC., 357 Center St. — Coopersville, Mich.

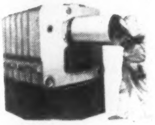
THE "EASIER" BOILER

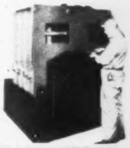
Easier to insulate

Easier to erect


Easier to build combustion chamber


Easier to enlarge capacity

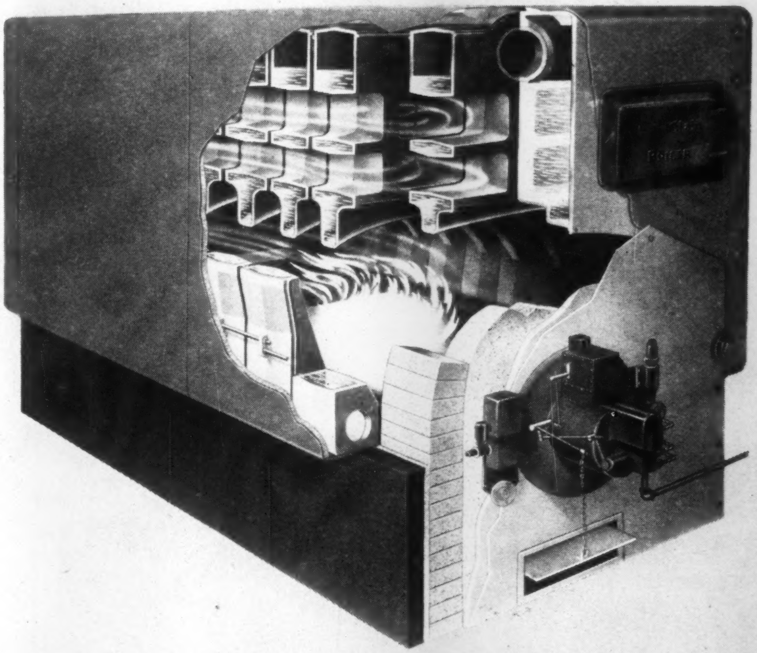

Easier to install breeching


Easier to install burner on special steel front plate

It is also easy to see why the Weil-McLain "HR" Series Boiler is completely outstanding for commercial, institutional and industrial installations.

This boiler was designed in cooperation with leading manufacturers of horizontal rotary oil burners and has their approval. The extra large combustion volume, greater primary heating surface, low heat release and balanced flue gas travel are among the features which contribute to highly efficient combustion and heat absorption. That's why the "HR" Boiler most effectively develops the economies obtainable with low-cost, heavy oils.

Cast iron sectional construction offers easier erection... less required space... easy enlargement of capacity... low maintenance cost and longer life. The special steel front of the "HR" greatly simplifies installation of the burner. A Weil-McLain "*extra value*" in every detail!



WEIL-McLAIN

HR SERIES BOILERS

FOR HORIZONTAL ROTARY OIL BURNERS

WEIL-McLAIN
HR

For complete data send for Bulletin C-188

WEIL-McLAIN
BOILERS · RADIATORS

Address Literature requests to Dept. AA-37

WEIL-McLAIN COMPANY
MICHIGAN CITY, INDIANA

One of . . .

Northern Ohio's Largest Industrial Distributors Stocks YOUNGSTOWN STEEL PIPE Exclusively

THE HARDWARE & SUPPLY

Akron's 97-year-old Hardware & Supply Co. knows quality pipe—its customers demand only the best pipe—so every length in their stock room is marked—"Youngstown". As this veteran distributor's thousands of customers in the Akron-Canton-Massillon area have found from experience, it will pay you to know and deal with your nearest Youngstown distributor. He's in business for only one reason—to supply what you want, when you want it, and in the quantity you require.

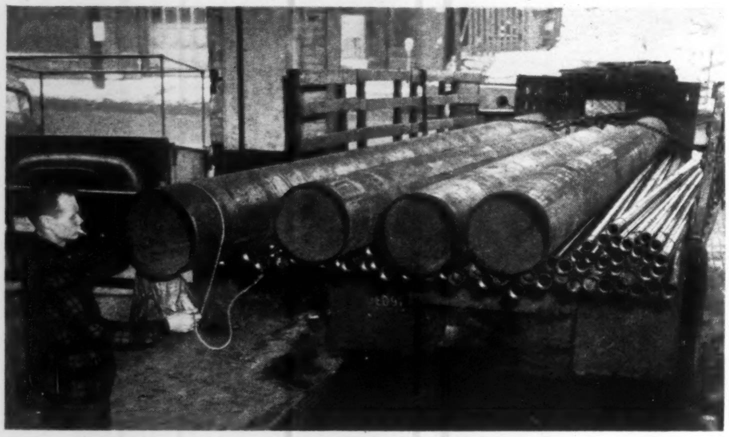
The Hardware & Supply Co. is typical of leading Youngstown distributors throughout the country who provide:

- Immediate delivery from large, complete stocks which permits reduction of your inventory
- A single source of supply that will simplify and expedite your purchasing, receiving, and bookkeeping, and,
- 24-hour service—365 days a year

Your Youngstown Distributor is waiting to serve you—why not call him today?

Next time you need steel pipe—for any use—specify Youngstown and secure these 7 points of uniform goodness

uniform ductility
uniform lengths
uniform threading
uniform weldability
uniform wall thickness and size
uniform strength and toughness
uniform roundness and straightness



Another load of quality Youngstown pipe is ready to leave the shipping dock—an hour after the order is received.

Hardware & Supply Co. can fill any customer's order from their large, complete stock of Youngstown pipe.

YOUNGSTOWN PIPE

THE YOUNGSTOWN SHEET AND TUBE COMPANY
Manufacturers of Carbon, Alloy and Yoloy Steel
General Offices - Youngstown 1, Ohio
District Sales Offices in Principal Cities

Big News!

RIDGID 65R

Now Has A Revolutionary New

True-Centering Workholder

Another RIDGID FIRST

RIDGID
OPEN
REMOVE
DIES
1½ 1¼

Patents
Applied For

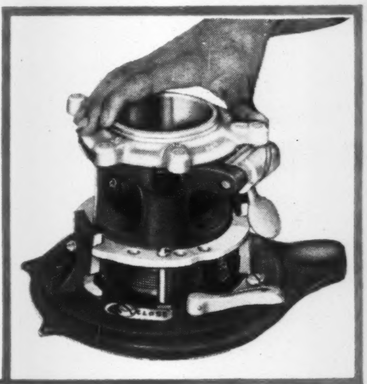
That Guarantees Always True Straight Threads

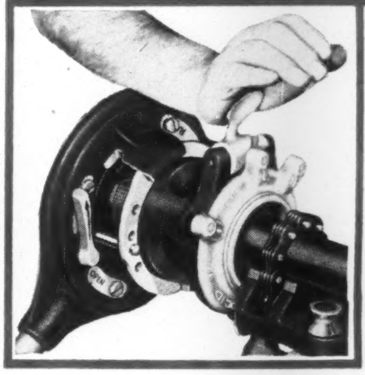
...even on over or under size pipe

Because All 3 Workholder Jaws Close At One Time!

Here's How It Works . . .

1. Turn cam plate which pre-sets workholder to desired pipe size, closes *all* 3 workholder jaws simultaneously by 1 mechanical action, for exact centering of die stock on pipe, even if pipe is over or under size.





2. When threader is on pipe, all 3 workholder jaws tighten in 1 action by bump of forged cam lever with palm of hand. Jaws grip and hold tight. Threads are *always* straight and true.

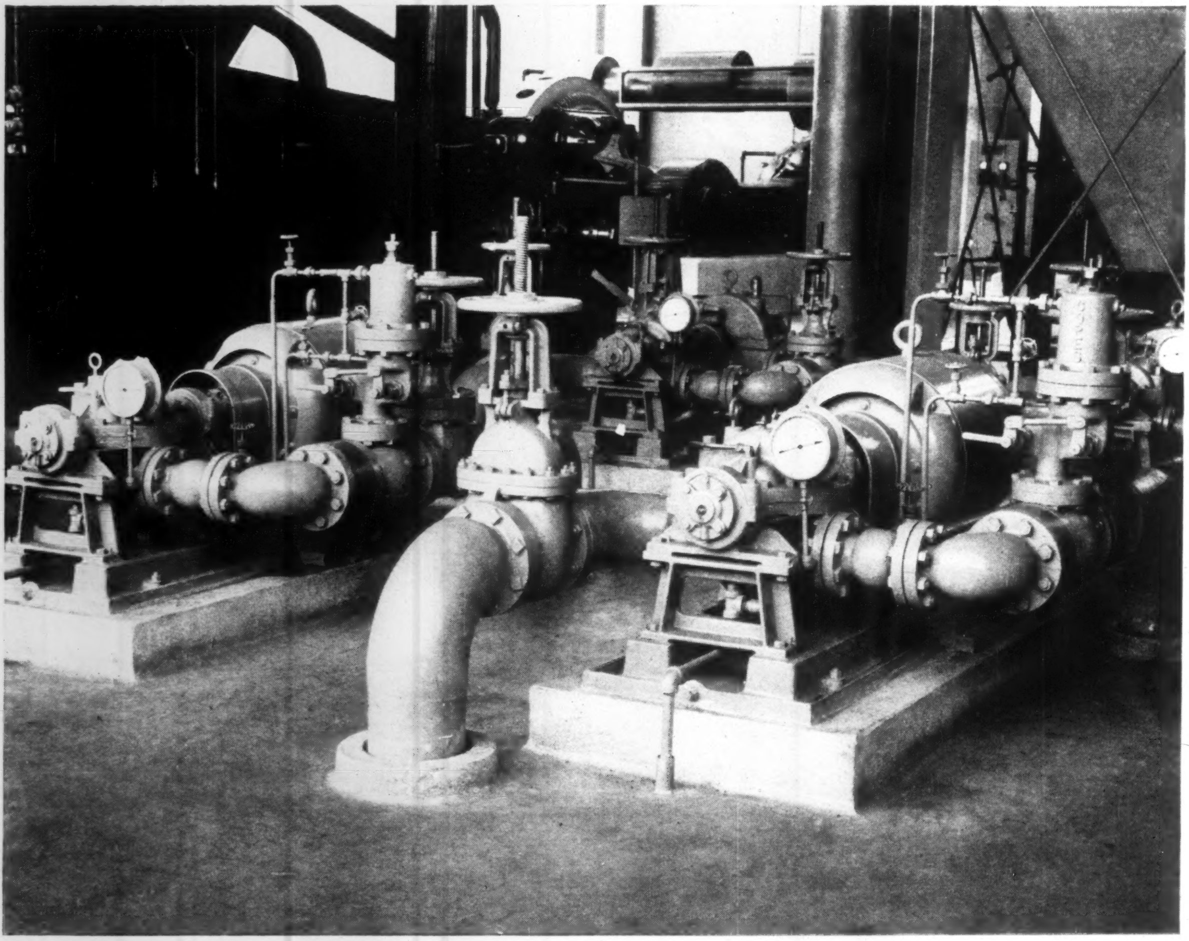
New TC Workholder fits your old 65R

. . . easy to change — ask your Supply House.

RIDGID 65R is jam-proof—kicks out automatically when standard thread is cut. Threads 1″ to 2″ pipe or conduit with 1 set of dies that stay in threader. Change from size to size in only 8 seconds. Instant workholder setting. With new TC workholder, 65R is far the most for your money—ask your Supply House today!

RIDGID
Work-Saver Pipe Tools

The Ridge Tool Company, Elyria, Ohio, U.S.A.

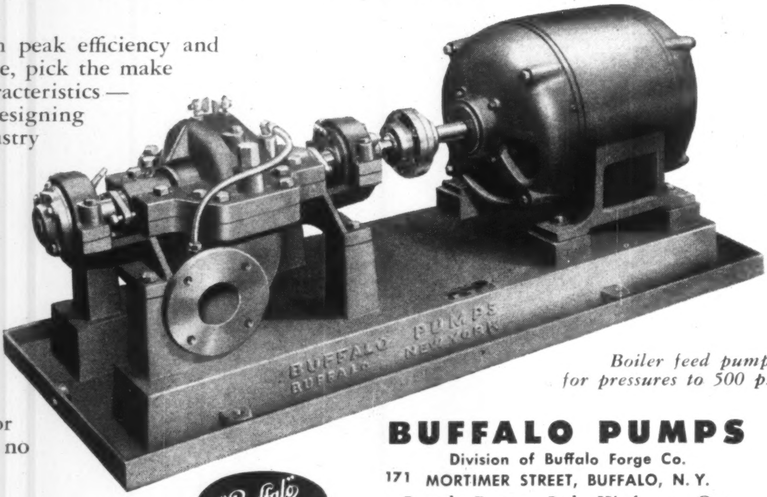


"Buffalo" Type RR Pumps on boiler feed at a large auto plant

"BUFFALO"–THE PUMPS THAT DON'T MIND BEING IN HOT WATER AND UNDER PRESSURE!

In selecting boiler feed pumps of both peak efficiency and year-after-year durability, under pressure, pick the make with the 80-year record for these characteristics — "Buffalo". This long experience in designing and building centrifugal pumps for industry has resulted in present-day "Buffalo" Pumps with every feature for maximum delivery at least power input — and for continuous service with negligible maintenance.

"Buffalo" Type RR two-stage and four-stage pumps have the typically efficient, balanced "Buffalo" impellers — the oversize bearings and shafts — the rugged casings with simply formed water passages and deep 8-ring stuffing boxes. Write for Bulletin 980 and see why we say there's no better buy!



Boiler feed pumps for pressures to 500 psi

BUFFALO PUMPS
Division of Buffalo Forge Co.
171 MORTIMER STREET, BUFFALO, N. Y.
Canada Pumps, Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

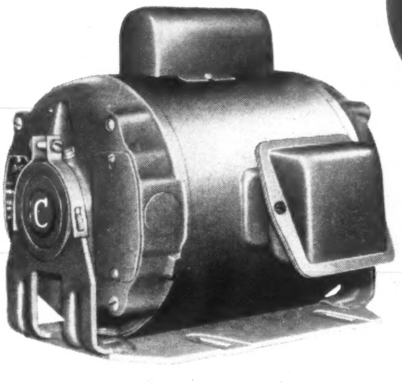
"Buffalo"

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

Your choice of normal or low starting current...

with Performance-Rated Century

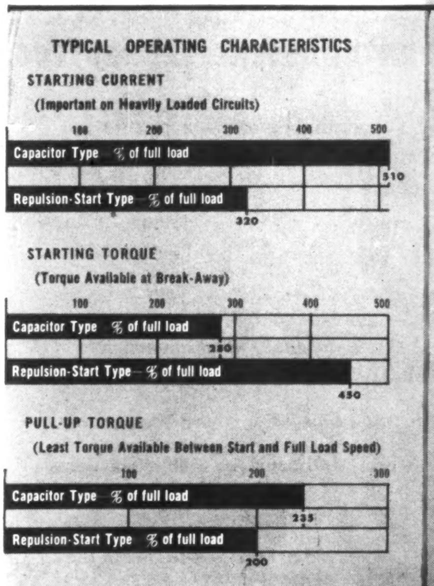
HIGH TORQUE, SINGLE-PHASE MOTORS

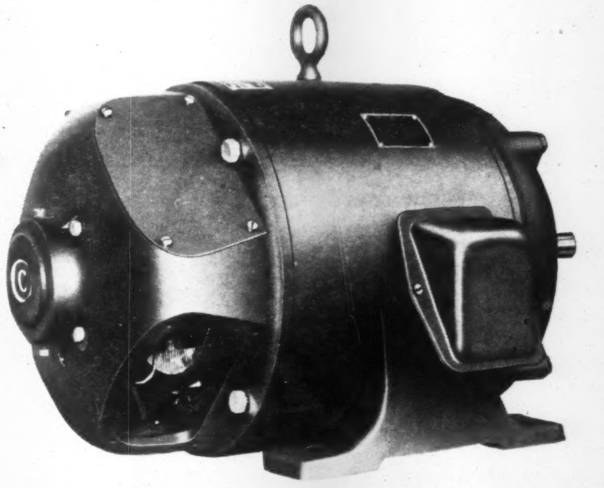


Capacitor Motors... ⅛ to 20 H.P. provide high starting torque, high pull-up torque and require normal starting current. They are available in drip proof, dust proof and explosion proof enclosures.

Even if you have severe starting current limitations, you can select the torque you need for sure starts and smooth pull-up to speed from the Century Performance-Rated Single-Phase line (see bar chart below for operating characteristics of two types of Century Single-Phase Motors).

Whatever Your Motor Job . . . there's a Century Motor Performance-Rated to handle it with top effectiveness. Contact your nearby Century branch office or Authorized Distributor.





Repulsion Start, Induction Motors (type RS)... ½ to 7½ H.P. provide very high starting torque, yet require unusually low starting current. They are available in drip proof and splash proof enclosures.

Performance-Rated©
Motors
⅛ to 400 H.P.

CENTURY ELECTRIC COMPANY

1806 Pine Street, St. Louis 3, Missouri • *Offices and Stock Points in Principal Cities*

CE-32

Cleaver-Brooks presents . . .

A REVOLUTIONARY NEW DEVELOPMENT IN THE ART OF BURNING RESIDUAL OILS

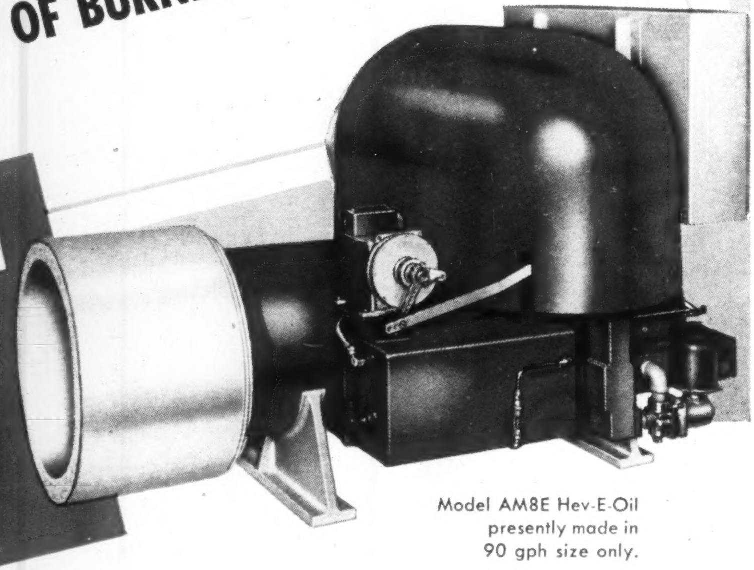
Hev-E-Oil

THE FIRST AIR-ATOMIZING

Burner

DESIGNED FOR

No. 6 Oil



Model AM8E Hev-E-Oil presently made in 90 gph size only.

. . . A TRIUMPH IN MODERN COMMERCIAL HEATING

NOW — for the first time in the industry — an air atomizing, gun-type burner designed for No. 6 or Bunker C oil. Previous methods of burning residual oils — with their inefficiencies and high maintenance — are now obsolete.

This great forward step in modern oil burning practice is another example of Cleaver-Brooks' leadership in burner research and engineering.

- No. 6 oil finely atomized — easily and completely burned.
- Burner equipped to bring hot oil to burner nozzle — ready for a perfect start at all times.
- Oil and air measured at all capacities — high CO_2 is maintained under all stack conditions.
- Straight electric ignition available.
- Pressurized lubrication increases service life.
- Fast installation — simple as a domestic burner.
- Latest type electronic controls are standard equipment — burner completely wired at factory.
- Burner completely fire-tested at factory.
- Low fire start — standard equipment.
- High-low modulation — standard equipment.
- Complete modulation available at slightly higher cost.
- Low and high fire easily set for most economical operation.
- Shape of flame can be adjusted for each particular installation.
- Post-purge insures no-drip, sure starting.
- Burner requires a minimum of service, a quality product made by Cleaver-Brooks — a leader in the development of combustion equipment.

Cleaver Brooks

DEALERS AND DISTRIBUTORS . . . write today — get the complete details on the new HEV-E-OIL Burner for No. 6 oil. CLEAVER-BROOKS COMPANY, Dept. C, 313 E. Keefe Ave., Milwaukee 12, Wisconsin.

HEV-E-OIL Burners . . . a quality product that builds your profit

New hospital

or existing hotel...

QUIET AIR CONDITIONING is especially desirable in hospitals and rest homes. In addition, patients can choose their own degree of comfort.

DETROIT STATLER HOTEL recently installed its first group of AIRditioners.

Modine AIRditioners are the quiet, fingertip answer to year-round comfort

A TURN of the dial . . . and Modine AIRditioners deliver the desired air-conditioned comfort—quietly, instantly, smoothly. This fingertip control provides personalized air conditioning for hotels, office buildings, apartments, hospitals, motels. AIRditioners assure initial economy, performance and style in new buildings. And they're ideal for remodeling existing ones . . . replacing unsightly radiators with attractive heating-cooling units.

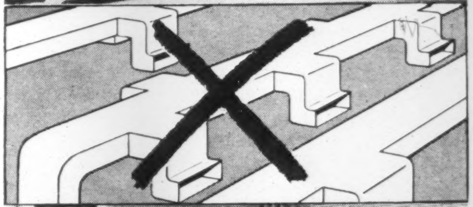
Ask the Modine representative listed in your classified phone book for Bulletin 755 — or write Modine Mfg. Co., 1509 DeKoven Ave., Racine, Wisconsin

Modine Airditioners®

In Canada: Sarco, Ltd., Toronto

A-1314

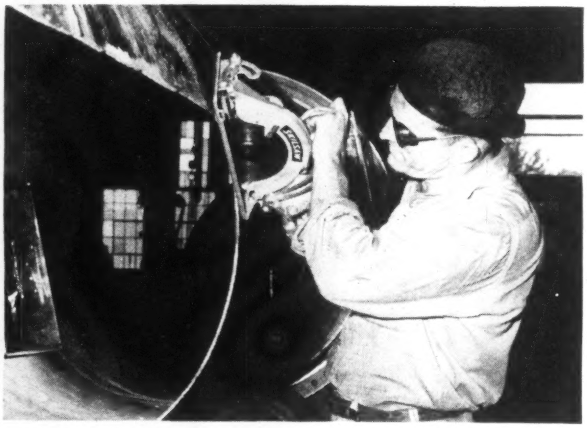
FINGERTIP control permits room occupants to select their degree of comfort.



NO DUCT WORK is needed. AIRditioners use same piping for water supply and return, plus drain . . . cost less to install.

A CHOICE of four enclosure types in capacities from 2/3 to 2 tons.

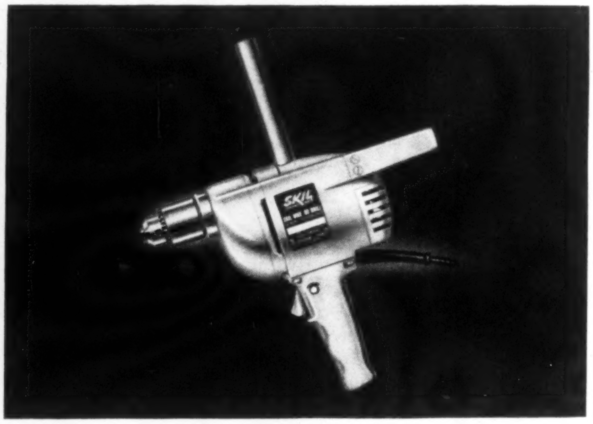
Saves $100 maintenance costs. Mr. Edward Staubitz, Treasurer of the Staubitz Sheet Metal Works, Cincinnati, says this about SKIL tools: "When we were shown a SKIL Model 852 Disc Sander, we were told to burn it up if we could. We tried but to no avail. With top usage our records show we saved over $100 on six SKIL sanders over the same period with other models. Our costs dropped 5 to 1."



SKIL Saw pays for itself. "Our SKIL Model 77 Saw paid for itself on the first job of metal cutting," says Mr. Greenway, superintendent of the Alpha Tank and Metal Manufacturing Co., St. Louis. "It completed the job four times faster. We use it to cut aluminum, copper and other materials. Cuts are required in all sizes and shapes. Our SKIL saw definitely is the handiest tool in the shop."

MECHANICAL CONTRACTORS SAVE with SKIL Tools

Saves servicing. West Brothers Sheet Metal Works, Atlanta, have used SKIL tools for 25 years in their shop. Mr. J. Hoyt West says, "We standardize on SKIL drills because they pack power for the toughest assignments. We have had our present SKIL Model 75 drills for over a year. Although they have had days of rough assignments—far above their recommended use—we have yet to have them serviced."



SAVE with NEW ½" Model 80 DRILL. All-new design: shorter, narrower—one pound lighter! New power for fast drilling on the toughest jobs. No matter what you have to drill, cut, sand or grind, there's a SKIL tool to do the job faster, better, cheaper. Let your SKIL distributor show you why. Let him show you the speed, power, versatility and ease of handling of all SKIL power tools.

SKIL
PORTABLE TOOLS

Made only by SKIL Corporation, Chicago 30, Illinois. Factory branches in all leading cities.

Send for
FREE *booklet*
on power tools

SKIL Corporation, HP-37
5033 Elston Ave.
Chicago 30, Illinois

In Canada:
3601 Dundas Street West
Toronto 9, Ontario

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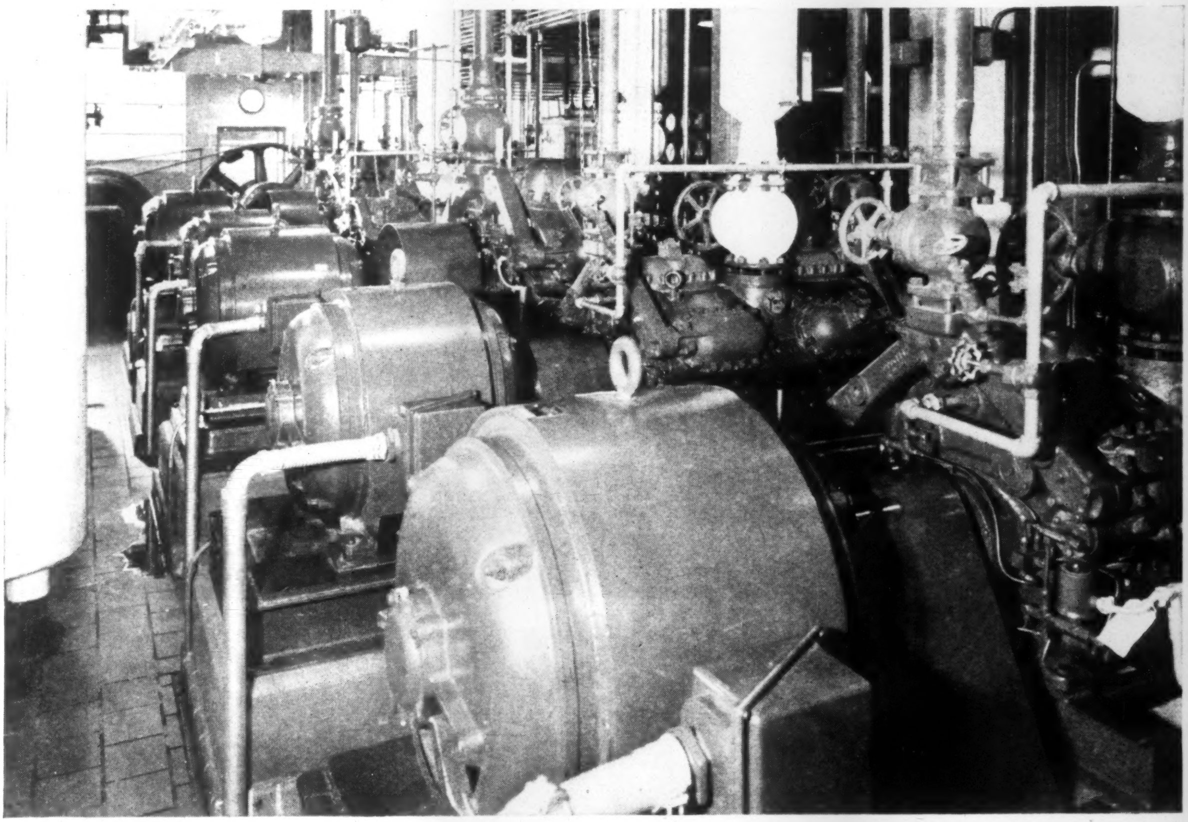
City______________Zone______State______

WAGNER ELECTRIC MOTORS . . . THE CHOICE OF LEADERS IN INDUSTRY



Solve big motor starting problems with Wagner Increment Motor-Starter Combinations!

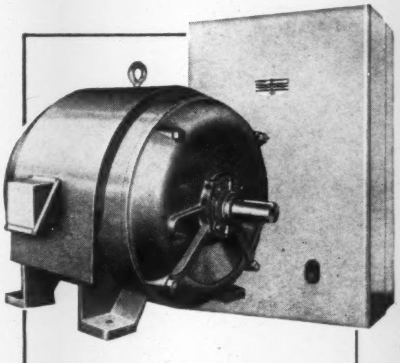
Eliminate "across the line" starts — cut voltage drop and line disturbance

This line of Wagner Increment Start Motors, ranging from 60 to 150 hp, and operating at speeds from 575 to 1160 rpm, drive compressors in a Memphis food processing plant. The motors start quickly and easily, with a minimum of line voltage disturbance, because they are designed for increment starting and are furnished with increment type starters.

Wagner Increment Motor-Starter Combinations provide *low cost control* . . . do not interrupt current between "start" and "run", as is the case with auto-transformer type starters . . . do not affect the running characteristics of the motors . . . yet fully meet the polyphase motor starting recommendations of the AEIC-EEI-NEMA.

Wagner two-step motor and starter combinations are suitable for most applications. For installations where unusually low inrush of starting current is required, Wagner can furnish 3, 4, 5, or 6 step increment motor-starter combinations.

Why don't you investigate the possibilities for savings by using Wagner Increment-start Motor Combinations on your big jobs? Your nearby Wagner engineer will help you select the increment motor and starter combination that meets your requirements. Call the nearest of our 32 branches or write for Bulletins MU-128 and MU-195.



Type RP polyphase motor — in ratings to 500 hp. with increment type starter.

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

M57-9

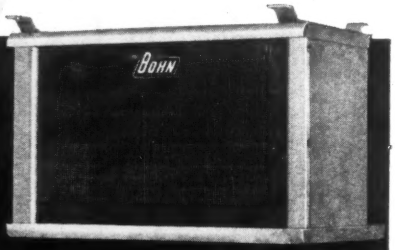
BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

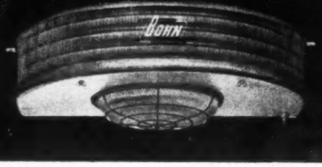
ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

BOHN *Presents*

Model D Back Bar Unit. Capacity range of 130 through 230 BTU per hr. at 1°T.D.



Model UC Unit Cooler. Capacity range of 260 through 2000 BTU per hr. at 1°T.D.



Model HR
Half Round.
Capacity range
from 260
through 1080
BTU per hr.
at 1°T.D.

the NEW ANGLE *in*

Commercial Refrigeration

rugged • lightweight • grained aluminum cabinets

- ***No Scratch***
- ***No Rust***
- ***No Paint***

The *NEW ANGLE* is better refrigeration equipment than ever before . . . at low cost . . . backed by BOHN quality and service.

Outstanding features include grained aluminum cabinets . . . rust proof fittings . . . full collar aluminum fins and copper tubing . . . reliable BOHN capacity ratings . . . life lubricated motors.

The new Model D is the ideal universal unit for all types and sizes of back bars. Model UC features built-in liquid distributor and patented air direction louvres. Model HR features a quick cleaning filter, a double drip hinged pan which prevents sweating, and air direction louvres formed in the fins.

Be sure of fine construction and economy. Write today for complete details on these and other models. Reserve your free copy of the new BOHN CATALOG BU-1.

BETZ DIVISION
BOHN
DANVILLE, ILLINOIS

Manufacturers of Commercial Refrigeration. Industrial Air Conditioning and Special Heat Transfer Surface

BOHN ALUMINUM & BRASS CORPORATION • BETZ DIVISION • DANVILLE. ILLINOIS

See Our Exhibit in Chicago at this Year's International Heating & Air Conditioning Exposition, Feb. 25-March 1.

HOW ABOUT
AVAILABILITY?

HOW ABOUT
QUALITY?

HOW ABOUT
IDENTIFICATION?

HOW ABOUT
YOUR REPUTATION?

Why try to cut corners with Question-Mark* fittings?

** Question Mark fittings: You can tell them by the lack of complete, permanent identification of manufacturer, wall thickness, weight, material . . . as required by A.S.A. code.*

Unknown welding fittings are as risky as unmarked turns on a busy highway. These blind spots in an expensive piping project cause slow-downs, confusion, trouble . . . waste time and money.

"Question Mark" fittings may look like a bargain on the price tag, but watch out for the after-costs . . . poor fit-up, impaired quality, questionable supply, lack of engineering service! Your reputation is at stake!

**A message in the interests of top quality piping . . .
by Tube Turns, Louisville, Kentucky.**

**HOW TO SAFEGUARD
YOUR REPUTATION**

tt
TUBE-TURN
TRADEMARKS
6-.280
WPB
SCH 40
tt WPB ATW 342

He knows he's getting the exact fitting specified on the blueprint because each TUBE-TURN product is clearly marked with all designations.

Save manhours...avoid piping risks with known fittings

You save purchasing time, get prompt delivery, speed up installation, and help assure reliable piping performance when you specify TUBE-TURN* Welding Fittings and Flanges. They meet all American Standard and Safety Code requirements. Each product is permanently marked with complete size and material designation. Your nearby Tube Turns' distributor gives you prompt delivery from the complete-line stock, and makes available Tube Turns' unmatched engineering service.

You *know* your piping investment is safeguarded when you specify and buy Tube Turns' products.

Your nearby Tube Turns' Distributor meets your needs promptly from the complete line of more than 12,000 Tube Turns' stocked items.

The Leading Manufacturer of Welding Fittings and Flanges

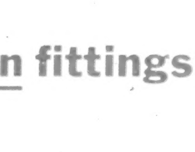
TUBE TURNS LOUISVILLE 1, KENTUCKY

A Division of National Cylinder Gas Company

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Detroit • Atlanta • New Orleans • Houston • Midland Dallas • Tulsa • Kansas City • Denver • Los Angeles • San Francisco • Seattle

In Canada: Tube Turns of Canada, Ltd., Ridgetown, Ontario • Toronto, Ontario • Edmonton, Alberta

*"TUBE-TURN"
and "tt" Reg.
U. S. Pat. Off.



THE NEW *Airtherm* AIR CONDITIONING UNIT

COMBINES THE BEST TIME-PROVED FEATURES IN THE INDUSTRY

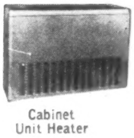
FOR NEW OR EXISTING

- ✓ OFFICES
- ✓ MOTELS
- ✓ HOTELS
- ✓ APARTMENTS
- ✓ INSTITUTIONS
- ✓ PUBLIC BUILDINGS

Here is Airtherm's answer to the demand for remote air conditioning without expensive ductwork. Features that have performed best in actual usage through the years are combined in this unit to give: (1) Maximum efficiency and operating life; (2) Quiet operation; (3) Versatility of installation; (4) Attractive appearance that blends with new or old buildings.

Airtherm units are made in four series from ½ to 2 ton nominal cooling capacity for cabinet or concealed installation, floor or ceiling.

AIRTHERM HEATING AND VENTILATING PRODUCTS



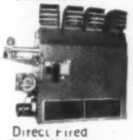
Cabinet Unit Heater

Gas Fired Unit Heater

Propeller Fan Unit Heater

Convector

Centrifugal Fan Unit Heater



Direct Fired Space Heater

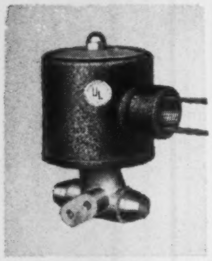
MAIL COUPON FOR DETAILS

Airtherm Manufacturing Co., Dept. A
700 S. Spring • St. Louis 3, Mo.

Please send specifications on the following products as checked ☐ Airtherm Air Conditioning Units ☐ Cabinet Unit Heaters ☐ Convectors ☐ Gas Fired Unit Heaters ☐ Propeller Fan Unit Heaters ☐ Centrifugal Fan Unit Heaters ☐ Direct Fired Space Heaters.

NAME ....FIRM ....

STREET ADDRESS .... CITY .... STATE ....



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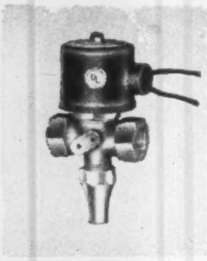
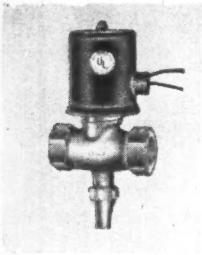
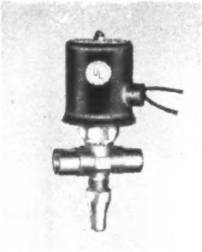


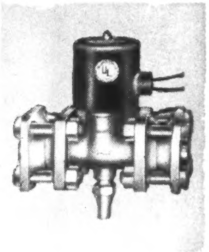
Type S220



Type M340



Type M635



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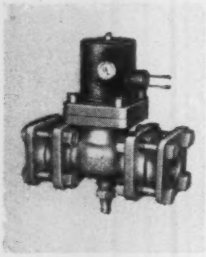
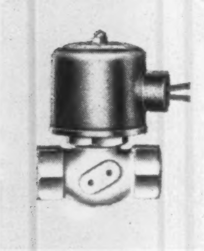
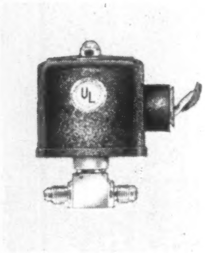


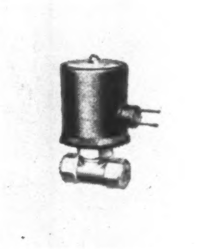
Types R6 and R2



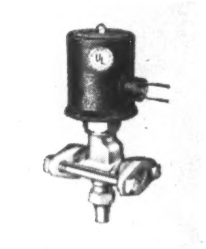
Type S804



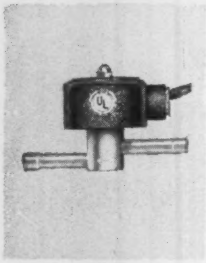
Type S101



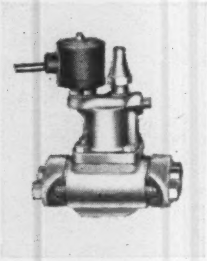
Type M9115



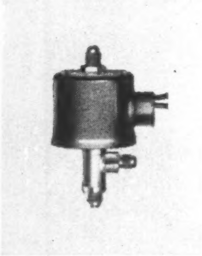
Type M8



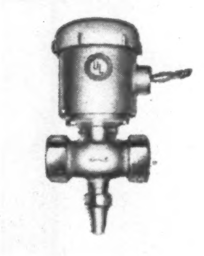
Type DS2228



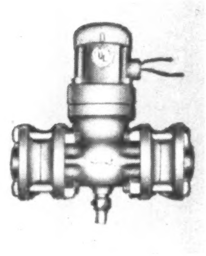
Types 905-13 and 14



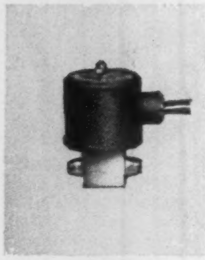
Type S608-1



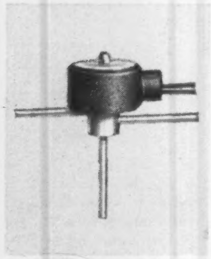
Type M3X



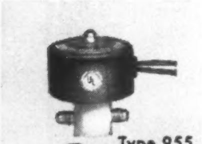
Type R2X



Type SIM55

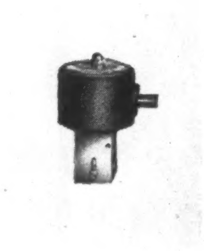


Type DS2355



Type 955

Type D953



Type DS1770

whatever the control problem, there's an ALCO SOLENOID VALVE

The most complete line for all types of refrigerant service; liquid, suction or hot gas discharge . . . brine, water, steam and air. Available in sweat or pipe connections.

The one complete line of refrigerant controls: Thermostatic Expansion Valves, Refrigerant Distributors, Solenoid Valves, Suction Line Regulators, Flooded Evaporator Controls and Reversing Valves.

ALCO

ALCO VALVE CO.

861 KINGSLAND AVE. ST. LOUIS 5, MO.

write for information

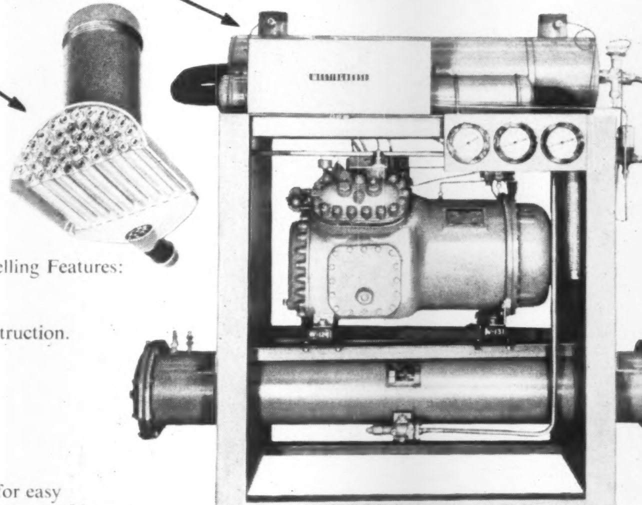
7329

Bid Lower with WESTINGHOUSE
Packaged WATER CHILLERS

They are *COST SAVERS* for you and your customers!

SPACE SAVERS!

These new packaged Westinghouse water chillers occupy one-third less space than most competitive models. Internal finned construction of the chiller has five times the heat transfer quality of prime tubing.



TROUBLE SAVERS!

Full line of Package Chillers with these Selling Features:
- Westinghouse hermetic compressors from 2 to 120 tons.
- Westinghouse non-ferrous chiller construction. ASME approved.
- Westinghouse condenser. ASME approved.

LABOR SAVERS!

Shipped completely assembled. Packaged for easy installation. Needs no costly electrical wiring or refrigerant piping on the job.

- **COMPLETELY FACTORY ASSEMBLED**—with all piping, control wiring, operating and safety controls, ready for use. Completely tested for capacity and performance. Components selected for your specific application. Built to your specifications. Carries standard Westinghouse warranty.

- **COMPLETE AUTOMATIC CONTROLS!** Liquid line solenoid valves, high-low pressure cutout, oil pressure protector, low water temperature cutout, discharge temperature cutout, water pressure safety switch, time delay relay, return water thermostat, crankcase heater, and control circuit transformer for voltage reduction to 110 volt line circuit.

- **SILENT, SMOOTH, STRONG, COMPACT!** Westinghouse compressor is isolated from frame. Flexible piping in suction and discharge lines to absorb vibration. Strong steel frame may be ordered in two parts to pass through standard 6' door. Unit assembles vertically or horizontally to meet your requirements.

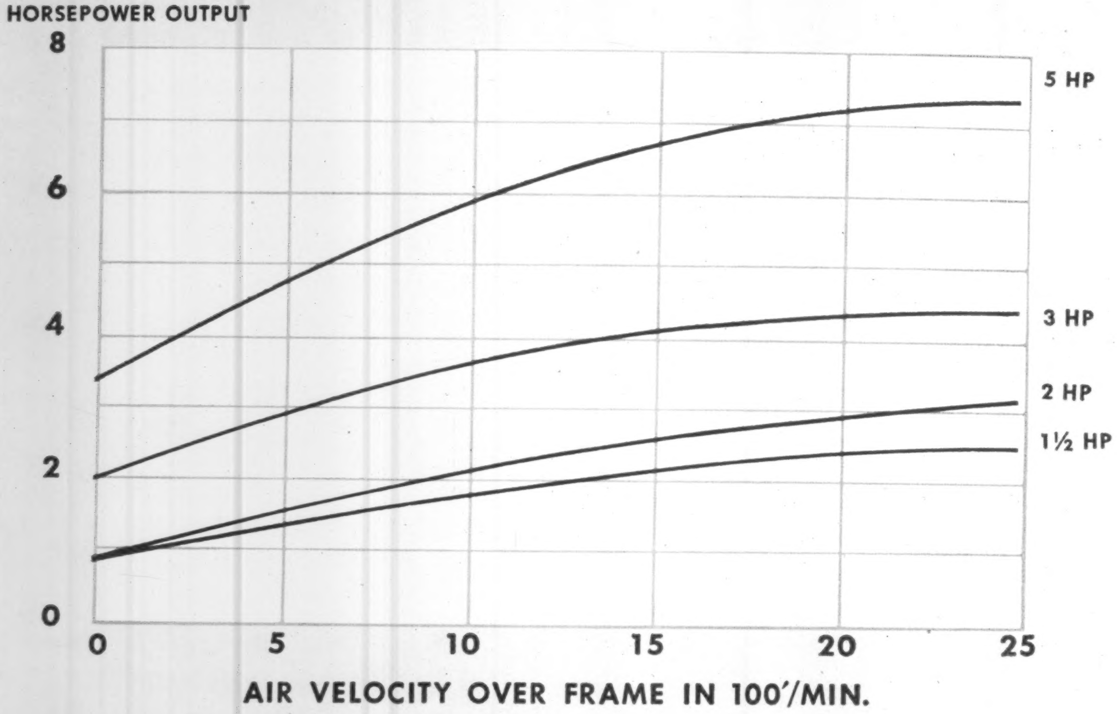
- **NON-FERROUS CHILLED WATER CIRCUITS!** Rust and corrosion resistant copper tubes and shell, brass tube sheets and baffles are cased in ice water insulation. Chillers are completely insulated and covered with a steel protective jacket.

- **OVER 1000 COMBINATIONS—2 TO 120 TON RANGE!** Now, a *single* factory assembled unit to meet *any* cooling need for process or comfort conditions. Two or more units easily combine to do *any* air conditioning or process job. May also be ordered without condensers, for use with separate air or water-cooled assemblies. Built to A.R.I. standards.

CALL THE MAN WITH ALL THE FACTS! You'll find your nearest Westinghouse Air Conditioning Office in the Yellow Pages, or write: WESTINGHOUSE ELECTRIC CORPORATION, AIR CONDITIONING DIVISION, STAUNTON, VIRGINIA.

YOU CAN BE SURE...IF IT'S Westinghouse

J-80532AB



SAVE 15% AND MORE ON FAN MOTORS

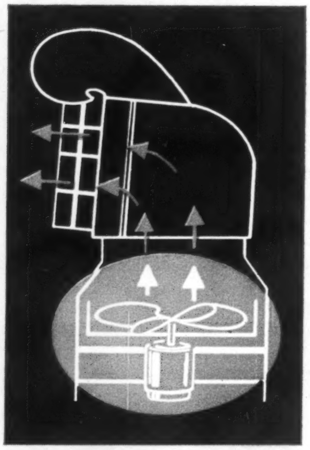
You can get as much as 50% more horsepower at no extra cost by using Reliance Air-Over Motors to drive fans and ventilators.

Reliance has developed a new line of totally-enclosed motors for fan service. These motors produce more horsepower when mounted in the air stream of the driven fan. Reliance Air-Over Motors will develop as much as 50% more than rated horsepower by utilizing the cooling effect of the fan's air flow.

These new Reliance Motors will save you money. By purchasing a lower horsepower rating you can save more than 15% and still meet job specifications.

Reliance Air-Over Motors are available from ½ through 40 horsepower—720, 900, 1200, 1800, or 3600 rpm. Common horsepower ratings are available from stock.

B-1547



RELIANCE R ELECTRIC

AND ENGINEERING COMPANY

DEPT. 363A, CLEVELAND 17, OHIO • CANADIAN DIVISION: WELLAND, ONTARIO

Sales Offices and Distributors in Principal Cities

SKIDMORE PUMPS have set a standard for performance and dependability since 1921

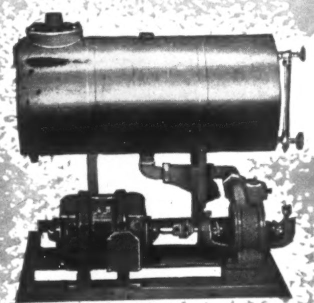
SPECIFY WITH CONFIDENCE

There's a Skidmore Pump designed for each and every heating requirement.

Write for bulletins

TYPE "CVS"

New, wider range of discharge pressures — from 10 to 40 lbs. Capacities range from 500 to 10,000 sq. ft. E.D.R.

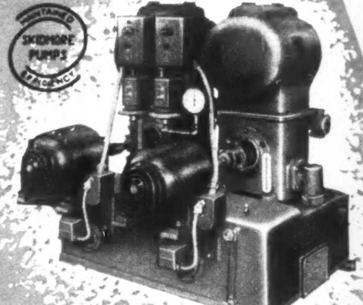


TYPE "TM"

Completely assembled on either steel or cast iron base — capacities, for boilers up to 250 H.P., with discharge pressures to 150 lbs.

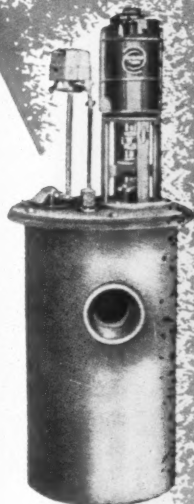
TYPE "HS"

Sturdily constructed for dependable service at small investment — capacities, 1,000 to 65,000 sq. ft. E.D.R., discharge pressures from 10 to 75 lbs.



VACUUM TYPE

Automatically adjusts itself to the varying conditions of the system. Efficiency maintained. Capacities ranging from 5,000 to 100,000 sq. ft. E.D.R.



TYPE "UV"

Designed for low return installations — capacities, 2,000 to 40,000 sq. ft. E.D.R. and discharge pressures from 10 to 75 lbs.

Send Coupon For Bulletins

SKIDMORE
CORPORATION
ST. JOSEPH, MICH.

SKIDMORE CORPORATION, ST. JOSEPH 6, MICHIGAN

Please send bulletins on the following pumps checked below.

CVS TM HS UV VACUUM

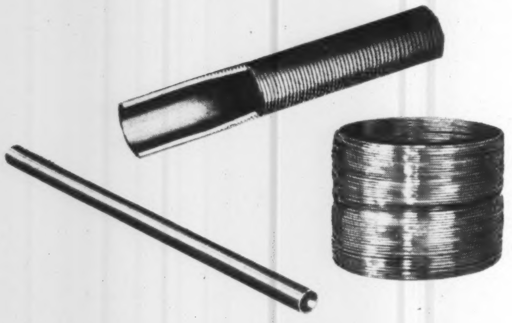
Name ....

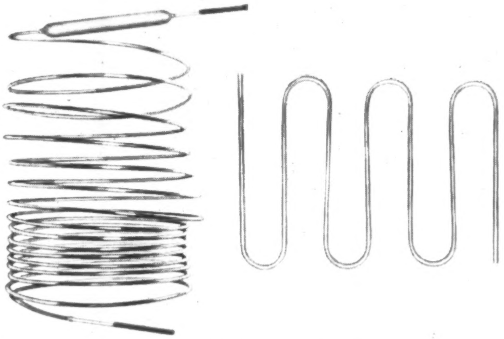
Firm ....

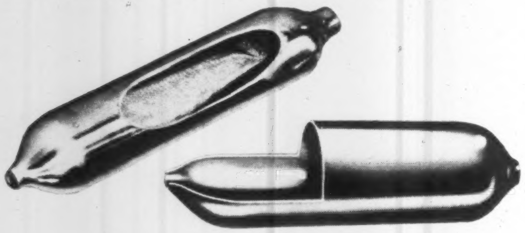
Address ....

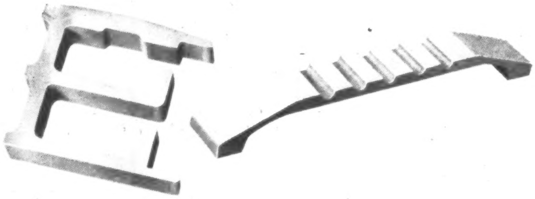
City .... State ....

LIGHTWEIGHT SHORT CUTS


Wolverine aluminum tube is available in straight lengths and coils, in finned and prime surface form.


Representative of Wolverine's fabrication techniques are the evaporator sub-assembly, left, and serpentine coil.


Wolverine's Spun End Process produces one-piece, tubular-shaped parts with fully or partially closed end treatments.


Wolverine extruded aluminum shapes are rigidly quality controlled to meet customer specifications.

TO INCREASED EFFICIENCY

Are you using aluminum tube, extruded shapes or fabricated parts of aluminum in your manufacturing process? If you are, Wolverine Tube can help you increase efficiency, cut costs and save valuable time.

Because Wolverine drawn and extruded aluminum tube is available in extra-long coils, for example, you can reduce stock chasing, free floor space and speed up assembly operations.

With Wolverine Trufin®—the integrally finned tube—you can do away with the work involved in assembling applied fin tubing and, at the same time, get a much better heat transfer job.

Wolverine's complete fabrication facilities, which include its exclusive Spun End Process,† can shape and bend tubing to your requirements—often doing in one, economical step that which requires a number of operations from your manpower and equipment.

These are but a few of the ways in which Wolverine Tube can help you do a better job. Why not get the facts from your Wolverine sales representative next time he calls? Write, too, for Wolverine's aluminum catalog.

†PROCESS PATENT APPLIED FOR

Wolverine Trufin available in Canada through the Unifin Tube Company, London, Ontario

CALUMET & HECLA, INC.
CALUMET DIVISION
WOLVERINE TUBE DIVISION
FOREST INDUSTRIES DIVISION
GOODMAN LUMBER COMPANY
CALUMET & HECLA OF CANADA LIMITED
CANADA VULCANIZER AND EQUIPMENT COMPANY LIMITED

WOLVERINE TUBE
Division of Calumet & Hecla, Inc.
1461 CENTRAL AVENUE, DETROIT 9, MICHIGAN
Manufacturers of Quality Controlled Tubing and Extruded Aluminum Shapes

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.

EXPORT DEPARTMENT, 13 EAST 40TH STREET, NEW YORK 16, NEW YORK

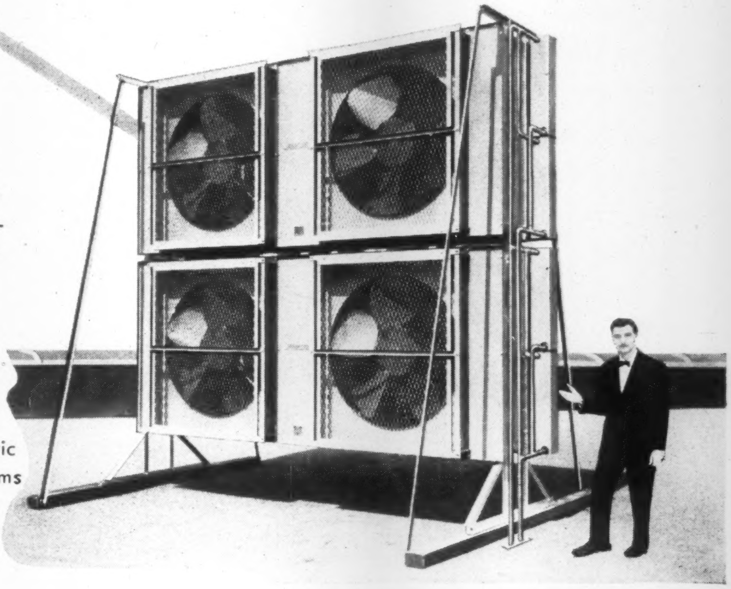
9827

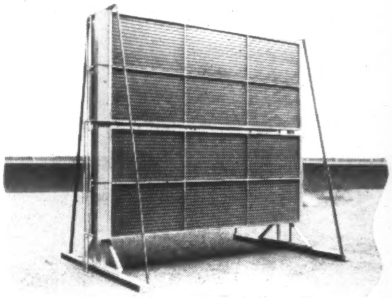
KRAMER

UNICON

GETS BIGGER and BIGGER

There is only one answer to large capacity condenser problems — the KRAMER UNICON. Every day more engineers plan larger tonnage installations — 50, 100 and even — 800 tons. And every day UNICONS are shipped to all parts of the world for giant-sized installations. No other air-cooled condenser can match the long, successful record of UNICON, backed by thousands of applications since 1937 — in the widest range of tonnages and climatic conditions. Your condensing problems can be best answered by use of the best — the KRAMER UNICON.





Space-saver UNICON, *as illustrated*, serves a 60-Ton air conditioning system, yet takes but 70 sq. ft. of roof space.

UNICON is a remote-type air-cooled condenser that requires no water. KRAMER UNICON can be used with any size compressor, REGARDLESS of horsepower. Any size refrigeration or air conditioning system can be air-cooled with UNICON, REGARDLESS of tonnage. UNICON requires less horsepower, less piping, is easier to install and costs less. KRAMER UNICON performs best — even in semi-tropical climates.

WRITE FOR BULLETIN U-210D

KRAMER TRENTON CO. • Trenton 5, N.J.

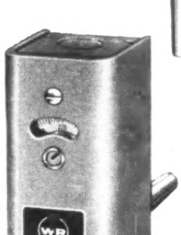
Another WHITE-RODGERS *Quality* FIRST!

new super sensitive TAPERED ELEMENT

for single element well-immersion hot water controls

... the most sensitive on today's market

WR
WHITE RODGERS
hot water control



We had to be certain this control was absolutely tops. There was one sure way: put it through rigorous, intensive performance tests.

What happened? The White-Rodgers single element well-immersion hot water control with tapered bulb and matching tapered well proved to be practically as sensitive as a direct-immersion element control. You now can get the advantages of direct-immersion performance without sacrificing the advantages of well installation.

- **Tapered bulb** *with matching tapered well provides continuous metal-to-metal contact and maximum heat transfer between water and bulb . . . giving the fastest response ever achieved in single well-immersion controls.*
- **Versatile replacement.** *Use the new tapered bulb in the old well for replacement purposes on old boilers—you don't have to change the well.*

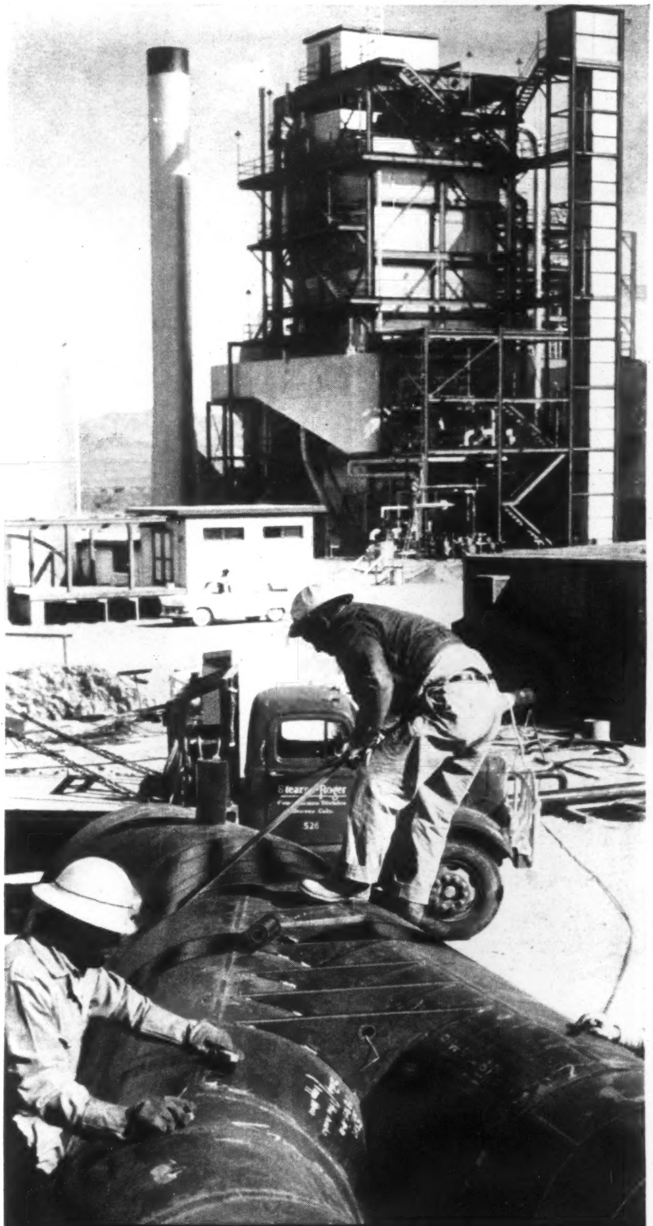
TEMPERATURE CONTROLS for MODERN COMFORT

WHITE-RODGERS

WR

ST. LOUIS 6, MISSOURI

TORONTO 8, CANADA



PRACTICAL PIPE PROTECTION

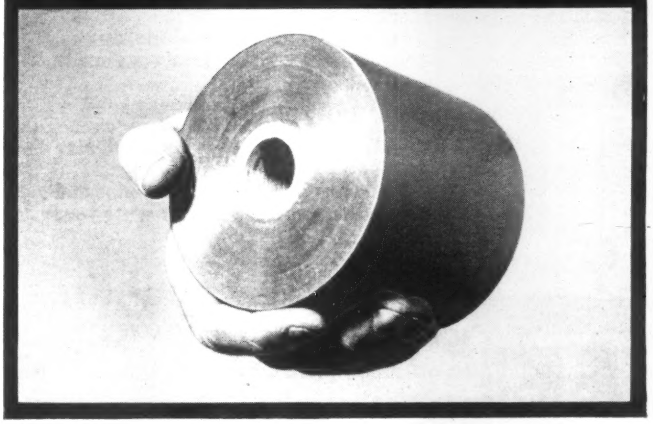
Practical protection for all pipe installations—and the only *practical* protection for some pipe coating jobs is "SCOTCHRAP."

That was the decision of the Stearns-Roger Co., Denver, when they had the job of coating these big pipes at a power station. Largest single pipes were 54 inches in diameter, tapering down to 36 inches. Stearns-Roger used "SCOTCHRAP" No. 51, 12 inches wide x 20 mils thick to wrap the pipes for complete protection.

Pressure-sensitive "SCOTCHRAP" is *polyvinyl chloride* plastic tape, tough enough to protect the biggest pipes; flexible enough to stand stress when pipe sags during final lifting into position. It can be applied on the job without heat and flame or special tools in absolute safety.

GET THE COMPLETE STORY. Send for free booklets describing protective qualities and easy application of "SCOTCHRAP." Just write on your letterhead to 3M Co., St. Paul 6, Minn., Dept. PD-37.

TAPE IT EASY



Quality pipe protection that rolls on dry...

REG. U.S. PAT. OFF.

SCOTCHRAP
BRAND
PIPE INSULATION

The term "SCOTCHRAP" is a registered trademark of Minnesota Mining and Manufacturing Co., St. Paul 6, Minn. Export Sales Office: 99 Park Avenue, New York 16, N.Y. In Canada: P.O. Box 757, London, Ontario.

We'll never let you down

THE J&L PRODUCER-DISTRIBUTOR TEAM

Quality Steel Pipe... Fast, Dependable Service

OVER 400
LEADING DISTRIBUTORS
CARRY J&L PIPE
LET THEM
SERVE YOU

You can rest assured you'll get completely dependable service when you rely on J&L and J&L Distributors for your steel pipe requirements.

First, you get superior pipe. J&L controls the *quality* all the way from raw materials through the finishing mills. That's why you find J&L steel pipe is long lasting and easy working on any application.

Second, you get dependable *service*. Your J&L distributor is always ready with:

1. **Complete stocks near at hand.**
2. **The right pipe for every job.**
3. **Technical service by steel pipe specialists.**

Whenever you need superior pipe and dependable service, phone or write your nearest J&L distributor.

J&L
STEEL

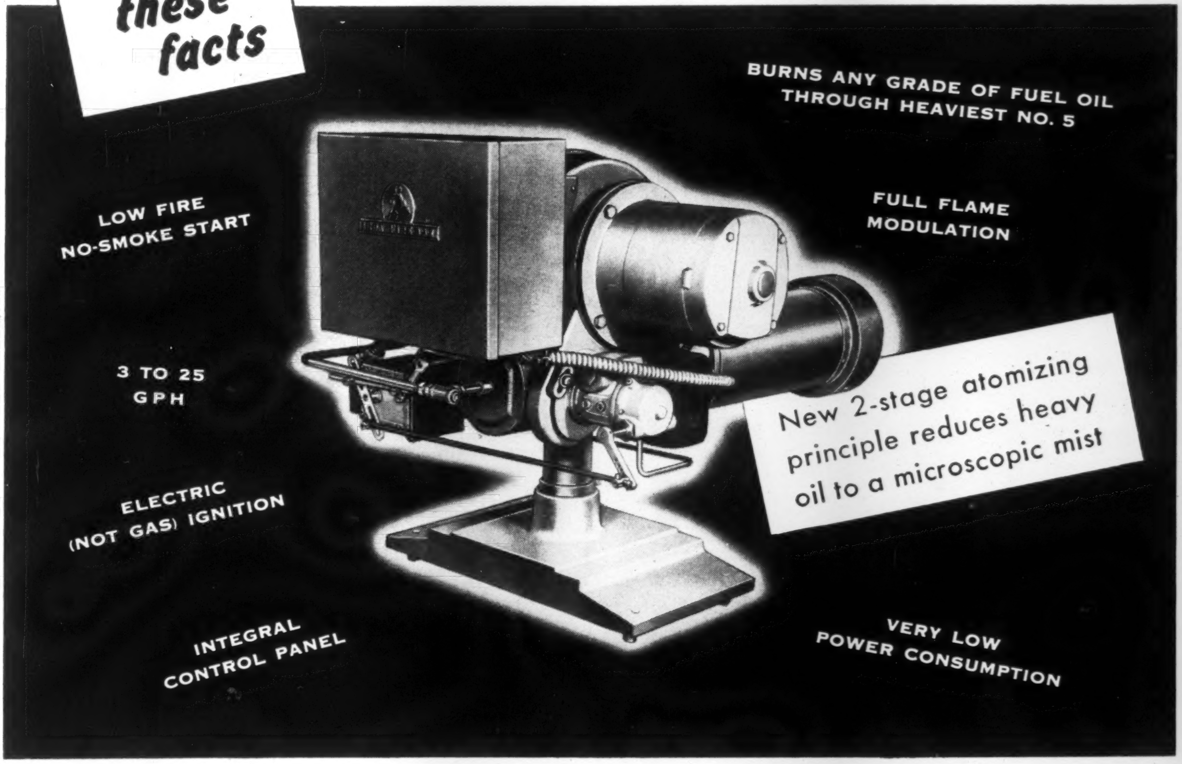
Jones & Laughlin
STEEL CORPORATION · PITTSBURGH

IRON FIREMAN MicroMist BURNER

TRADE MARK

*a **reliable** new method of firing low-cost heavy oils, including heavy No. 5*

check these facts


BURNS ANY GRADE OF FUEL OIL THROUGH HEAVIEST NO. 5
LOW FIRE NO-SMOKE START
FULL FLAME MODULATION
3 TO 25 GPH
New 2-stage atomizing principle reduces heavy oil to a microscopic mist
ELECTRIC (NOT GAS) IGNITION
INTEGRAL CONTROL PANEL
VERY LOW POWER CONSUMPTION

Why is it called the MicroMist burner?

The basic engineering advance used in the Iron Fireman MicroMist burner is a revolutionary new atomizing method. Heavy oils including *heavy* No. 5, are reduced to minute particles having the characteristics of a gas rather than a spray. The oil is so finely divided that it becomes an oil mist or fog that will remain in air suspension up to 24 hours or longer.

The heart of the Iron Fireman MicroMist burner is an ingenious supercharger, or compressor. The oil is mechanically atomized, as oil and air pass into the compressor. Such mechanical atomization is as far as other burners go. But in the revolutionary MircoMist burner, the compressor-atomizer further reduces the oil spray, by heat of compression, to a microscopic air-oil vapor.

This highly combustible vapor (which is easily ignited by an electric spark) is directed into the firebox by the nozzle. Unlike other oil burners, the nozzle is *not* a critical part, because it has nothing to do with atomization. There are no small passages subject to clogging. Heating of oil is required only for the heavier grades of No. 5, and then only for starting or pumping. The power load is exceptionally low. Extremely precise modulation is achieved through a variable volume pump.

Look at these additional features

The Iron Fireman MicroMist burner is as easily installed as a conventional gun type burner. It has two important uses: as a conversion burner or as a component part of a packaged boiler-burner unit. No special boiler front or boiler pitting is required. The choice of oil grades is almost unlimited. Integral control panel is wired and tested at the factory. Fuel and maintenance costs are low. It fires low-cost heavy oils with little more attention than a domestic oil burner. Available for low fire start, high-low or modulating firing.

IRON FIREMAN®

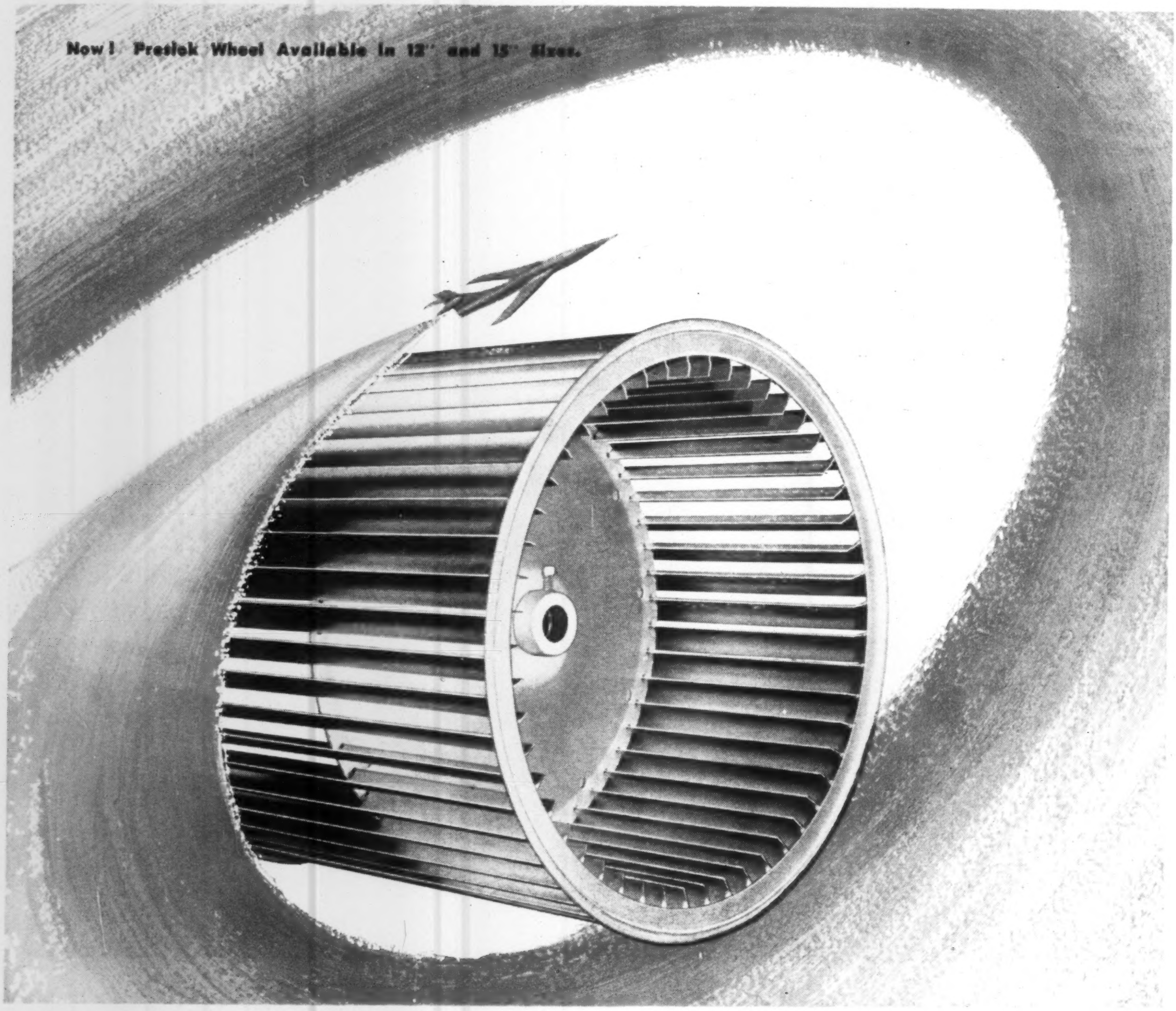
AUTOMATIC FIRING EQUIPMENT FOR OIL, GAS, COAL

SEND FOR MORE INFORMATION

IRON FIREMAN MANUFACTURING COMPANY
3362 W. 106th St., Cleveland 11, Ohio.
(In Canada, 80 Ward Street, Toronto, Ontario.)

Please send more information and specifications on the Iron Fireman MicroMist burner.

Name____________________
Firm____________________
Address____________________
City__________Zone____State______


Now! Preslok Wheel Available in 12" and 15" Sizes.

GIVE YOURSELF A SPEED 'MARGIN OF SAFETY'

Specify Preslok® Wheel . . . Guarantees 50% More Operating Speed

Are your modern air conditioning requirements calling for greater speeds, higher statics? *Preslok is guaranteed to increase your operating speed maximums by at least 50%!* With Preslok, the center disc grips the blade mechanically by an exclusive Lau locking method. Four disc fingers slip into the blade aperture and are pressed together in locking position. *Preslok eliminates ballooning at higher speeds . . . insures a quiet operation.*

One more advance for Lau engineering. One more answer to the needs of original equipment manufacturers, made possible by superior Lau engineering and production skills.

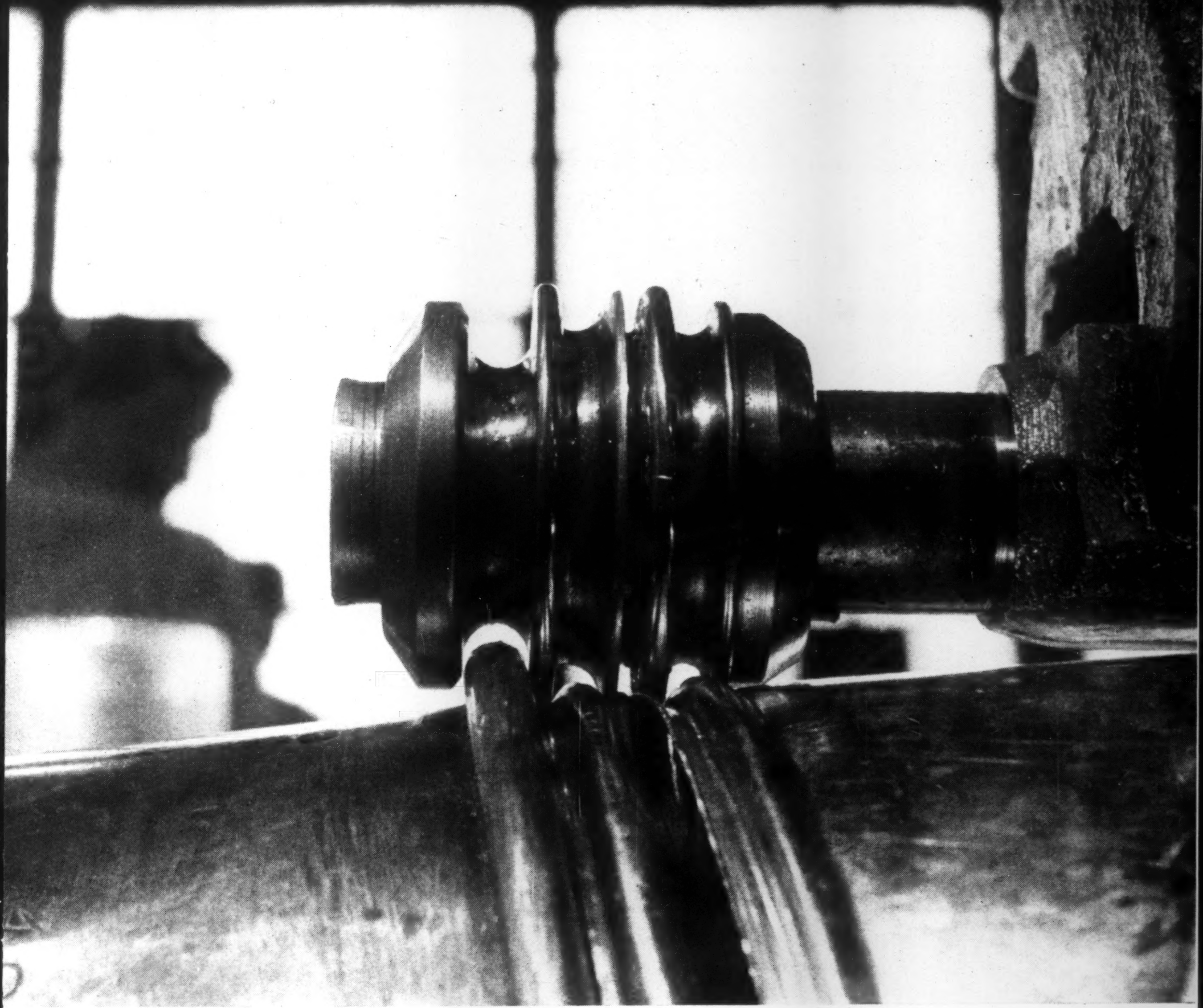
The Lau engineering skills are available to the entire air-moving industry . . . and specifically to your business *whenever you need them.*

Perhaps your organization is confronted with a difficult air-moving problem right now. If so, why don't you call in Lau, who have pioneered so many advances in more than 25 years of service. Write Dept. M, today.

THE LAU BLOWER COMPANY
2007 Home Avenue, Dayton 7, Ohio
Azusa, California. In Canada: The Lau Blower Company of Canada, Ltd., Kitchener, Ontario

World's Largest Manufacturer of Air-Conditioning Blowers

3-57



"NO MATTER HOW TOUGH THE FABRICATING JOB, WEIRKOTE'S® ZINC COATING STAYS PUT!"

Weirkote users know *that* as well as they know their own names. And no wonder! Look how profitably Weirkote zinc-coated steel fits into a fabrication operation.

Weirkote has the tight, continuous-process zinc coating that can stand up to every fabrication procedure, such as the beading and cutting of elbow tubes pictured above, and *stay* tight. No flaking or peeling problems. Far less chance of hidden flaws or only temporary corrosion resistance in the finished product.

In a nutshell, we produce a zinc-coated steel sheet that enables you to give your customers even more built-in value for their dollars. You simplify your production problems and make some important cost savings at the same time.

Why wait? Find out how Weirkote's corrosion resistance, strength and ability to come through severest fabrication stresses unblemished, can help you. For free booklet write to Weirton Steel Company, Dept. M-4 Weirton, West Virginia.

WEIRTON STEEL COMPANY

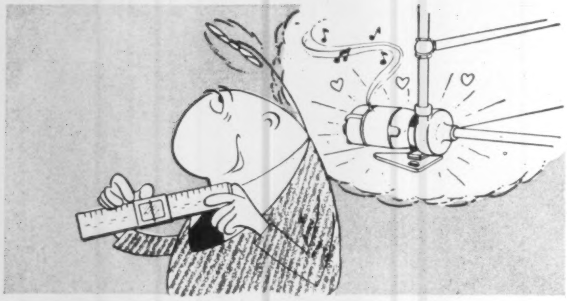
WEIRTON STEEL COMPANY

WEIRTON, WEST VIRGINIA

a division of

NATIONAL STEEL CORPORATION

HOW *Cool Carl* the Competent Contractor SOLVED Pump Size Problems

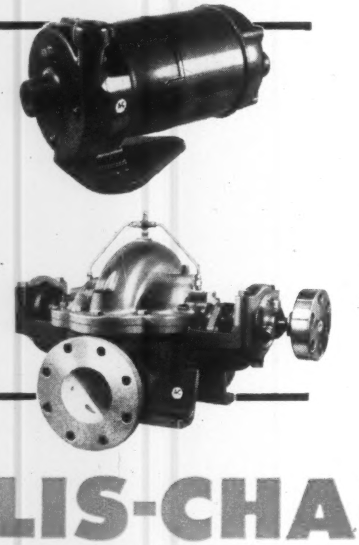


He wanted to supply the *right pump* for each of his many and varied installations.

He knew he didn't want to deal with a different pump supplier for each application.

Fractional and Integral Horsepower pump line has capacities to 2500 gpm, heads to 400 feet. All close-coupled models have only two base sizes for entire line . . . only two bolts needed to install.

Other Types of Pumps . . . specially designed for air conditioning . . . offer capacities up to 2500 gpm and heads to 550 feet. Even these larger pumps are available for delivery when you need them.



He knew he couldn't afford trial-and-error

He knew Allis-Chalmers Air Conditioning Pumps

Cover 99% of All Pumping Requirements

Capacities up to 2500 gpm
Heads up to 550 feet

Cool Carl (as usual) chose the most efficient method of solving pump size requirements — by specifying Allis-Chalmers. He found it easy to specify the *right pump* for each of his varied jobs . . . from the complete Allis-Chalmers line.

The extra dependability of Allis-Chalmers pumps, supplied with motor and control — designed to work as a unit — reduced Cool Carl's service call-backs — kept his customers happy.

You, too, can save time and money . . . increase your profits . . . by contacting your nearby Allis-Chalmers pump representative or distributor; or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS A-C

A-5252

MAKE-UP AIR... or COMFORT VENTILATION

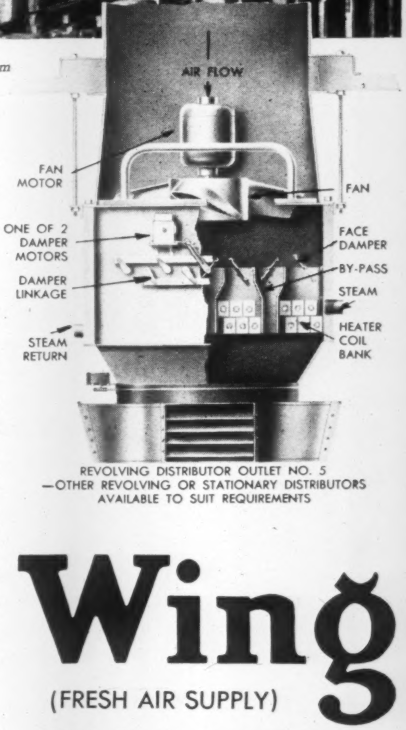
Wing FAS-HCR Heater in factory making asbestos products

Wing FAS-U Heaters in battery-charging room

Wing FAS Heaters deliver fresh air at room temperature... with no danger of freezing

Manufacturing processes frequently create heat, fumes, vapors, dust, etc., which must be removed at the source by fans or exhaust systems, and must be replaced, both to permit the exhaust systems to function efficiently, and for the comfort of the workers. For when a building is "starved for air", cold air will rush in through cracks and crevices, trying to eliminate the partial vacuum, and consequently causing much discomfort.

Wing FAS Heaters are designed to deliver to the building an amount of air equal to that which is exhausted, and at just the right temperature. The coils of these heaters cannot freeze, for steam is at full pressure at all times. Temperature is controlled by dampers on heating coils and by-pass passages. Get the complete details in new Fresh Air Supply Bulletin FAS-1.



REVOLVING DISTRIBUTOR OUTLET NO. 5
—OTHER REVOLVING OR STATIONARY DISTRIBUTORS
AVAILABLE TO SUIT REQUIREMENTS

Wing

(FRESH AIR SUPPLY)

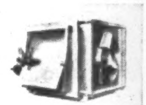
FAS HEATERS

L. J. Wing Mfg. Co.

140 Vreeland Mills Rd., Linden, N. J.
Factories: Linden, N.J. and Montreal, Canada
In Europe: WANSON, Haren-Nord, Brussels, Belgium

WING REVOLVING HEATERS

WING FANS



WING DRAFT INDUCERS

WING TURBINES

Mail the coupon for bulletin

L. J. Wing Mfg. Co. HP-3
140 Vreeland Mills Rd., Linden, N.J.

Please send copy of Fresh Air Supply Bulletin FAS-1.

Name..
Firm..
Address.......................................
City.................... Zone..... State......

The Stearns-Roger Building, home office of the firm at Denver, Colorado, designed, engineered, and constructed by Stearns-Roger with Mr. J. Roger Musick as consulting architect.

Air Conditioning in the mile high city . . .

and Ingersoll-Rand Centrifugal Pumps play their part . . .

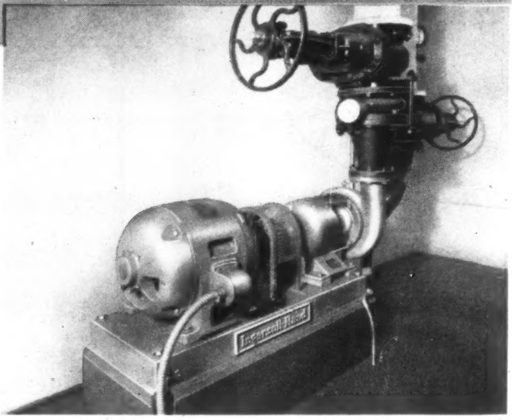
Installations such as this are becoming the rule rather than the exception these days. Even in the cooler areas of the country, office buildings, theatres, shopping centers, restaurants, hotels, hospitals, etc. are catering to the comfort of their employees and customers with central system air conditioning.

Ingersoll-Rand Centrifugal Pumps from ¼ horsepower up are ideal for cooling tower or chilled water service anywhere. These dependable pumps help give indoor comfort day in and day out with minimum maintenance and maximum efficiency.

When you are working on an air conditioning job check Ingersoll-Rand Circulating Pumps to do a bonus job for you. In the meantime, write for full information on I-R pumps for air conditioning service. Remember, the job is never too small nor too large for the Ingersoll-Rand Line.

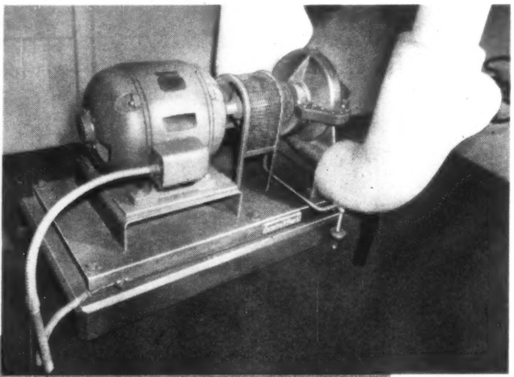
Ingersoll-Rand

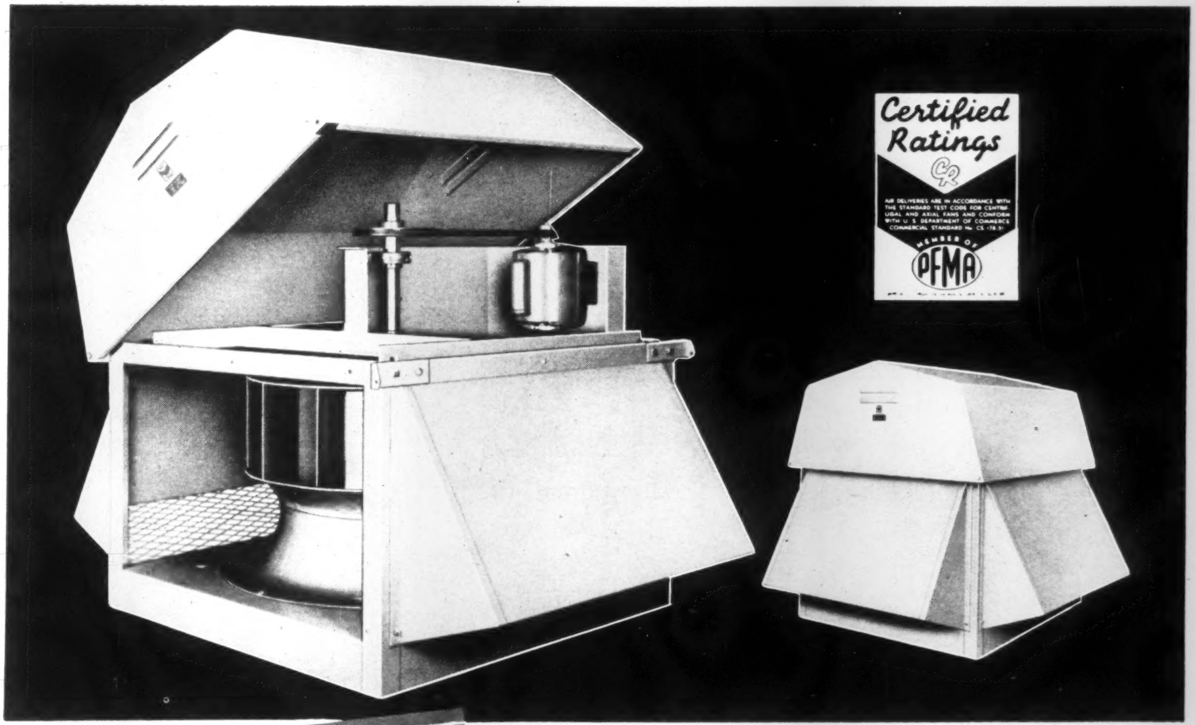
9-165 **11 Broadway, New York 4, N. Y.**



An Ingersoll-Rand Class 4CRVL 20 horsepower cradle-mounted pump on cold water circulation service. Delivery 860 gpm—head 55 feet.

An Ingersoll-Rand Class 4DMV 20 horsepower horizontally-split pump on cold water circulation service. Delivery 610 gpm—head 85 feet.




Certified Ratings
CR
AIR DELIVERIES ARE IN ACCORDANCE WITH THE STANDARD TEST CODE FOR CENTRIFUGAL AND AXIAL FANS AND CONFORM WITH U. S. DEPARTMENT OF COMMERCE COMMERCIAL STANDARD No. CS 178-51
MEMBER OF
PFMA

PFMA CERTIFIED RATINGS

NEW *Peerless Electric*®

Centrifugal Roof Ventilator...

DEVELOPED AND MANUFACTURED WITH APPLIED CENTRIFUGAL BLOWER PRINCIPLES

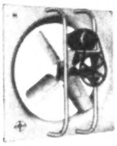
QUIET! . . . Matching wheel cone accurately fits venturi inlet to create quieter, smoother air movement. Excellent for churches, auditoriums, hospitals, and schools.

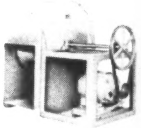
ADAPTABILITY! . . . Fits standard curb sizes. Lower horsepower ratings for quieter operation. Higher horsepower for commercial and industrial applications.

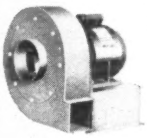
PERFORMANCE! . . . Each unit air-tested, and rated to assure certified ratings. Construction gives exceedingly high efficiencies. Detailed performance data completely covered in Bulletin SDA-220.

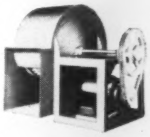
STURDY! . . . All welded construction. All material is 16 ga. or over. Built for the life of the building.

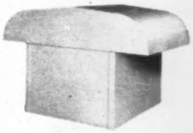
A COMPLETE LINE OF AIR MOVING EQUIPMENT











Charter Member of the Air Moving and Conditioning Association, Inc.

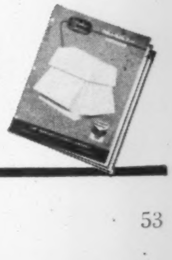
FAN AND BLOWER DIVISION

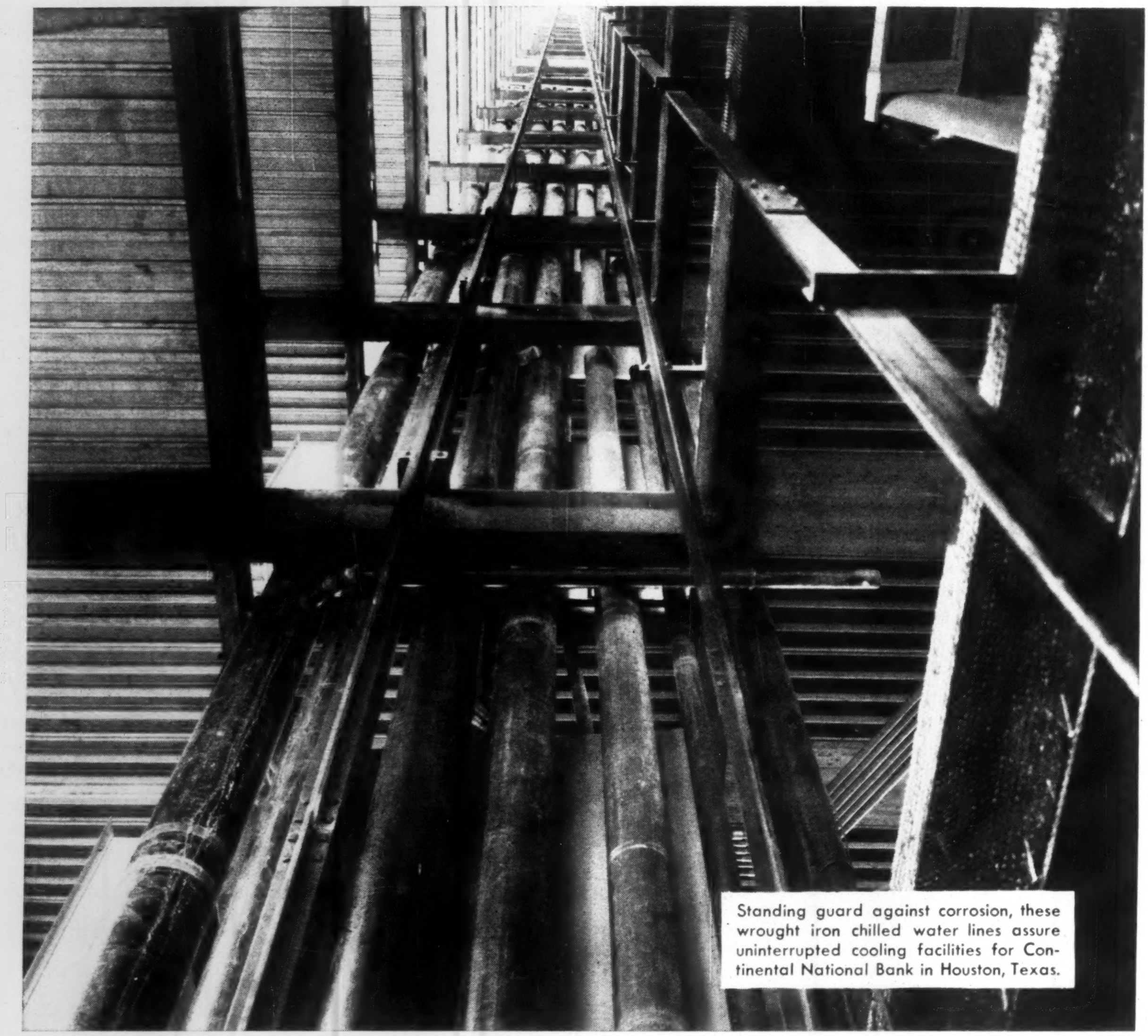
THE *Peerless Electric*® COMPANY

1409 W. MARKET ST. • WARREN, OHIO

FANS • BLOWERS • ELECTRIC MOTORS • ELECTRONIC EQUIPMENT

Write today for Bulletin SDA-220 on Peerless Centrifugal Roof Ventilators





Standing guard against corrosion, these wrought iron chilled water lines assure uninterrupted cooling facilities for Continental National Bank in Houston, Texas.

Air Conditioning with Wrought Iron Pipe saves premature maintenance and replacement costs

Wrought iron pipe's ability to last a long, long time in air-conditioning service can save the cost of emergency repairs usually associated with less durable piping materials.

This resistance to corrosive attack stems from the thousands of iron silicate fibers which make up wrought iron's structure. These glasslike, non-rusting fibers prevent pitting and rapid penetration.

We have case history evidence of wrought iron pipe's reliability in carrying corrosive brines and waters. Our booklet, *Wrought Iron in Refrigeration and Air Conditioning Systems,* gives the details. Write for a copy.

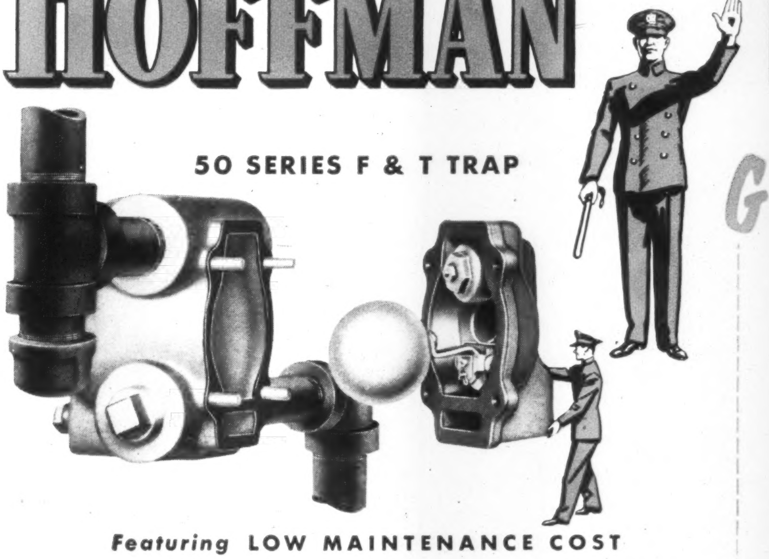
A. M. Byers Company, Pittsburgh, Pa. Established 1864. Division Offices in Boston, New York, Philadelphia, Washington, Atlanta, Pittsburgh, Chicago, St. Louis, Houston, San Francisco. International Division: New York, N.Y.

Available in Canada and throughout the world

BYERS Wrought Iron Tubular and Hot Rolled Products

ALSO ELECTRIC FURNACE QUALITY STEEL PRODUCTS

HOFFMAN TRAPS



GUARD AGAINST STEAM WASTE

Hoffman Traps provide improved design to *function more effectively and economically in removing condensate* from steam lines and equipment.

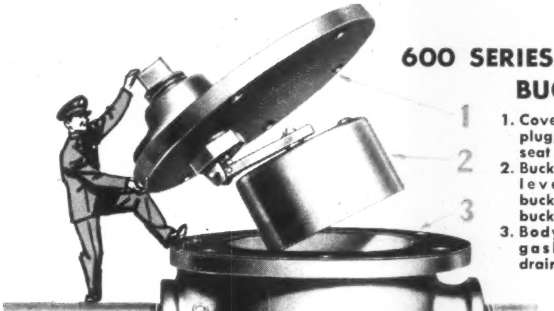
Hoffman engineers have anticipated steam requirements that demand less maintenance time and operating costs. Typical of Hoffman's complete line are the Traps illustrated, each with removable cover, pin and seat for quick inspection and cleaning.

Featuring LOW MAINTENANCE COST

Float and Thermostatic Traps are so designed that all working parts of the trap are a part of the removable cover. Once installed there is no necessity for the breaking of any pipe connection for cleaning and repairing.

1. **Compact Thermostat Assembly**
2. **Durable, accurately machined Valve Lever and Seat Assembly**
3. **Copper Float Ball Assembly**
4. **Graphite Impregnated Asbestos Gasket**
5. **Heavy Duty Cast Iron Cover**

600 SERIES INVERTED BUCKET TRAP

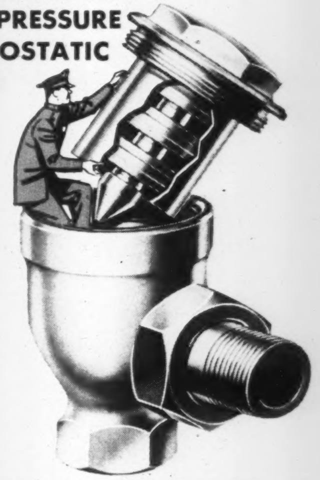


1. **Cover assembly with plug, valve seat, valve seat holder.**
2. **Bucket assembly with lever, valve stem, bucket pin, lock nut and bucket.**
3. **Body assembly with gasket and bottom drain plug.**

HIGHLY EFFICIENT AND EASILY ACCESSIBLE INTERIOR DESIGN

Hoffman Bucket Traps operate intermittently and are ideal for draining condensate and air from steam lines or equipment where large quantities of air and condensate must be discharged. They are easily inspected, cleaned and serviced by merely removing the cover assembly.

LOW, MEDIUM & HIGH PRESSURE THERMOSTATIC TRAPS

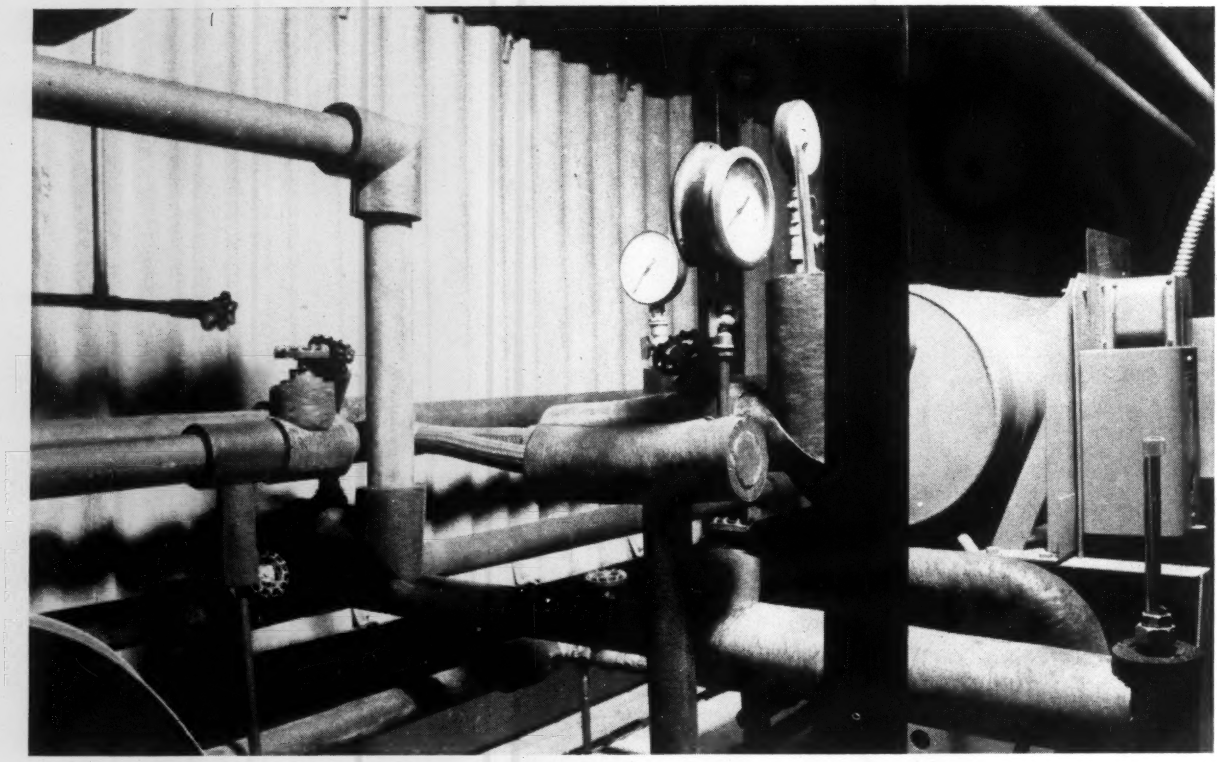


RENEWABLE THERMOSTATS and VALVE SEATS

A complete line of Low, Medium and High Pressure Thermostatic Traps for service with radiation, dryers, sterilizers, mangles, cookers and similar uses. Renewable thermostats and seats are important constructional features contributing to long life, low cost service. Medium and High Pressure Traps have stainless steel pins and renewable seats.

For full particulars, write for catalogs on Bucket Traps, Float and Thermostatic Traps or Thermostatic Traps

HOFFMAN SPECIALTY MANUFACTURING CORP.
1700 WEST 10TH STREET, INDIANAPOLIS 7, INDIANA



Intricate piping in confined space can be insulated easily with Armstrong Armaflex. Extreme flexibility simplifies handling, reduces application time as much as 50% when compared with wrap-on type coverings.

Stop condensation on fluid cooling lines with this new insulation

You can stop condensation on commercial and residential air-conditioning lines with Armstrong Armaflex®. This new, foamed plastic pipe insulation completely seals out moisture and air. No separate vapor barrier is needed. Armaflex remains dry in service, so its low K-factor of 0.28 at 75° F. stays low for the life of the installation. This insulation also will withstand 200 F. on hot lines or during the heating cycle on dual-temperature lines.

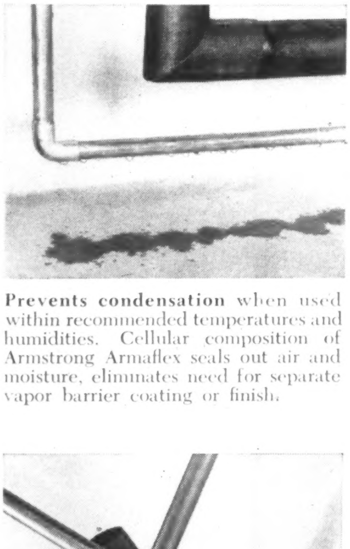
Armaflex is remarkably flexible, can actually be tied into knots. This great flexibility can speed installation. Slipped over pipes or copper tubing, Armaflex follows contours readily without any special cutting or fitting. If lines are already in operation, Armaflex is simply slit lengthwise, snapped in place, and quickly sealed with cement.

Armaflex is clean to work with—will not chip, crumble, or rub off. Waste is negligible. It will not support combustion, is safe to install before sweat fittings are made. Armaflex comes in 6′ lengths, for all sizes of pipes and tubing from 1/4″ up to 3 1/8″ o.d.

Send for free booklet giving full details on this amazing new insulation. Write Armstrong Cork Company, 3003 Sherman Street, Lancaster, Pa.

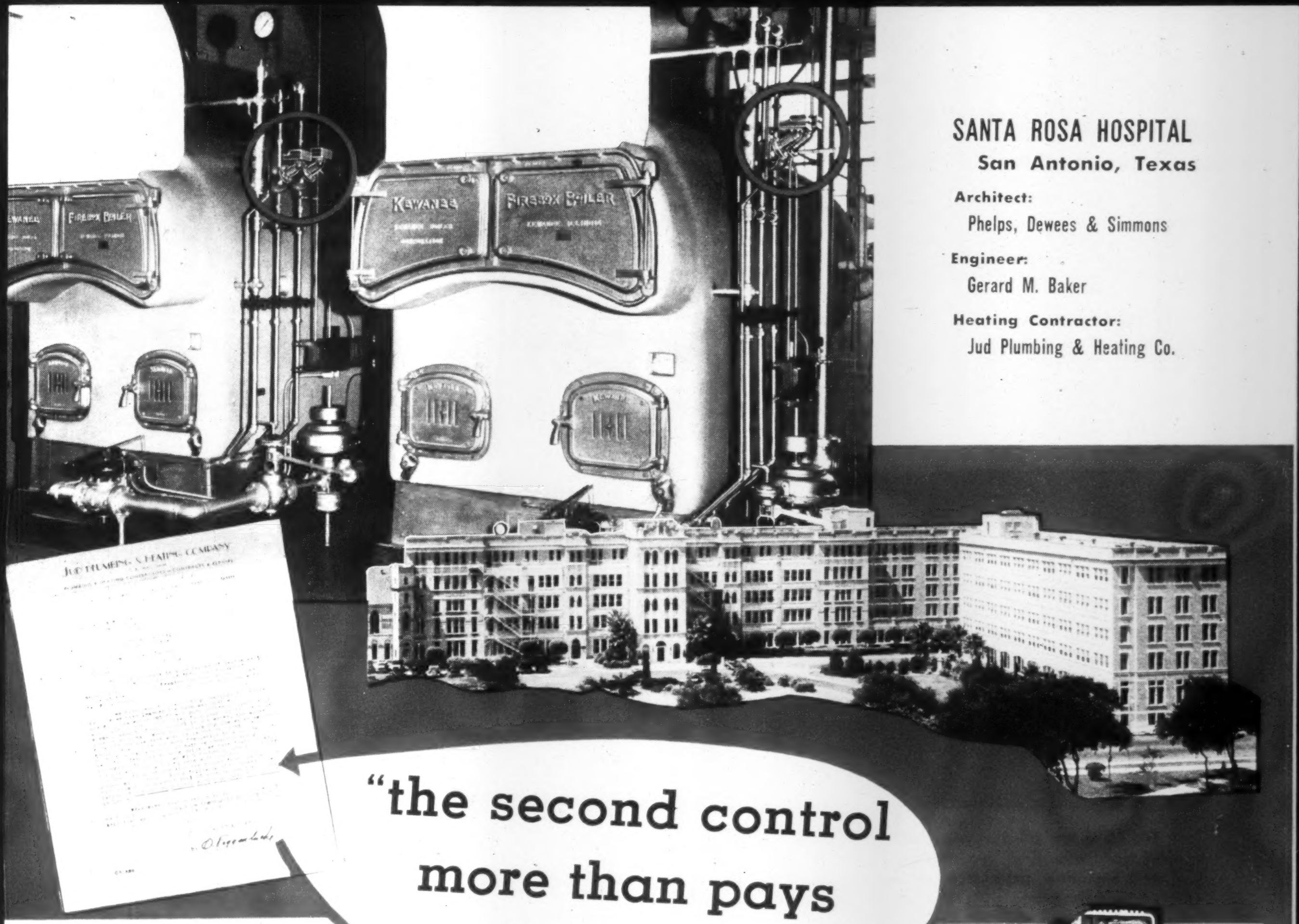
Armstrong

INDUSTRIAL INSULATIONS



Prevents condensation when used within recommended temperatures and humidities. Cellular composition of Armstrong Armaflex seals out air and moisture, eliminates need for separate vapor barrier coating or finish.

Fast, easy fabrication of fitting covers is accomplished by miter-cutting pieces of Armaflex and cementing them together with Armstrong 520 Adhesive.



SANTA ROSA HOSPITAL
San Antonio, Texas

Architect:
Phelps, Dewees & Simmons

Engineer:
Gerard M. Baker

Heating Contractor:
Jud Plumbing & Heating Co.

"the second control more than pays for itself"

HERE you see the utmost in boiler water level control keeping excellent company. Those No. 150 Pump Controllers and Low Water Cut-offs are installed on two large modern Kewanee firebox boilers in the boiler room of a big new addition to San Antonio's already large and famous Santa Rosa Hospital.

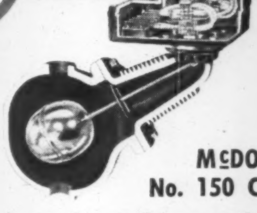
The men and firms who turned out this commendable job are listed above. An interesting aspect of the engineering is the use of two McDonnell No. 150 Controls on each boiler; one positioned higher than the other; the upper control used solely to control the feed pump; the lower, solely as a low water cut-off to stop the gas burner.

In a letter from the heating contractor, the reason for this arrangement was given: When the controls were installed, it was decided that local conditions would produce considerable fluctuations in the boiler water level which would often cause the low water cut-off switch to stop the burner when there was no actual condition to warrant cutting off. By setting the low water cut-off so that it will stop the burner only when there is a serious low water condition, unnecessary service calls are avoided. As a result, says the letter, "the second control more than pays for itself."

The resourcefulness to meet special conditions in a practical way is characteristic of men who know their heating and equipment. So it is not surprising to find McDonnell equipment in so many of these well engineered, capably-executed installations.

McDONNELL & MILLER, *Inc.*, 3500 N. Spaulding Ave., Chicago 18, Ill.

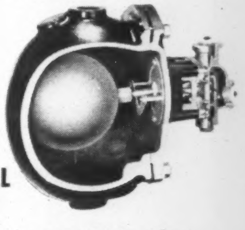
Doing One Thing Well



McDONNELL
No. 150 Control

Maximum Steam Pressure, 150 lbs.
Underwriters' Listed

Holds boiler water level within the close limits that assure maximum steaming efficiency and fuel economy. Ask for complete set of installation and wiring diagrams covering both single and battery boiler jobs.



McDONNELL
No. 27T

Make-up Water Feeder

An excellent team-mate for the No. 150, this McDonnell make-up water feeder is mounted on the receiving tank to maintain a minimum water level at all times.

Your Jobber Stocks Them

McDONNELL *Boiler Water Level Controls*

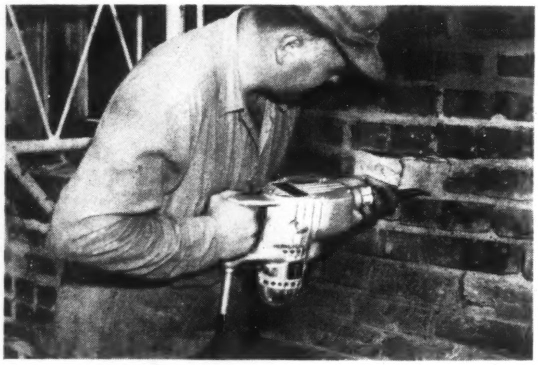
Cut down installation costs with
Thor air or electric utility tools

AIR THOR NO. 15 UTILITY HAMMER

Thor No. 15 is an all-purpose tool which drills, chips or breaks concrete and masonry. Weighs only 14 lbs. Converts instantly from a self-rotating rock drill to a non-rotating hammer with a flick of an external cam lever. Free swiveling hose. Easy lubrication.

This lightweight air tool is really four tools in one. Thor's exclusive stop rotation gives you a light demolition tool, a drill, a light clay digger, a chipping hammer all in one compact tool. It's easy to handle, easy to use and mighty easy on air. Try it and prove its performance on the job.

ELECTRIC THOR U-100 HAMMER



If it's an electric all-purpose tool you need, Thor's U-100 hammer is ideal. The U-100 breaks up concrete or stone—gouges, cuts or shapes wood—chips and scales metal or paint—drills stone, concrete or brick. You can't afford to be without it on any installation job.

The Thor U-100 hammer is offered with a variety of accessories including: star drill, chisel, bull point, mortar chisel, bush hammer, scaling chisel, web cutting tool, flat wood chisel and wood gouge. This versatile electric hammer delivers a powerhouse punch that's no trouble to handle.

Thor
PORTABLE POWER
TOOLS

Ask your Thor distributor for a demonstration of the No. 15 Air Utility Hammer and the U-100 electric hammer. Also ask to see Thor's complete line of electric tools. Thor Power Tool Company, Prudential Plaza, Chicago 1, Illinois

THOR POWER TOOL COMPANY, CHICAGO
Branches in all principal cities

THE MARK OF QUALITY

BARBER COLMAN

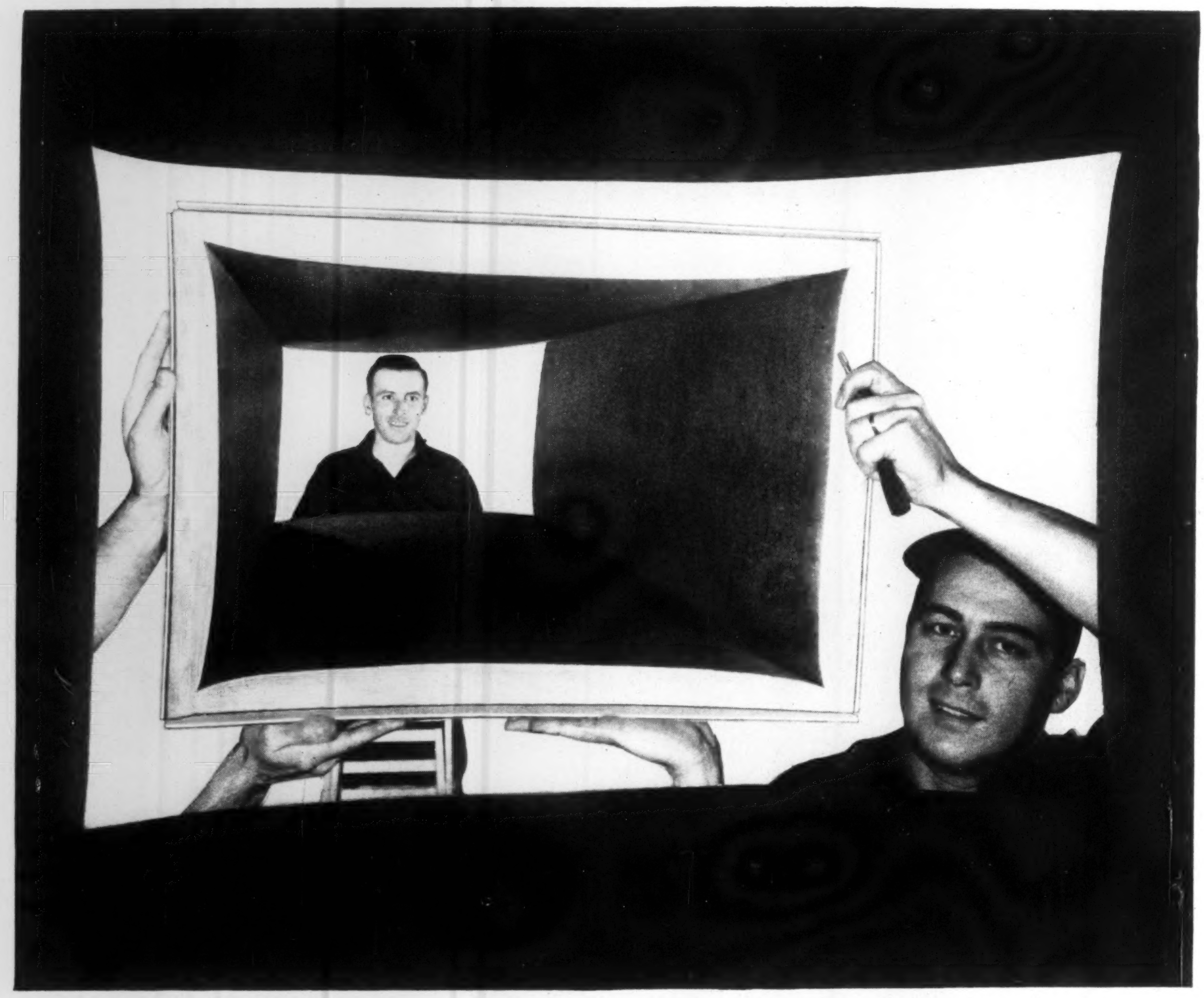
Automatic Controls

"what's the word for the latest in precision temperature control?"

Electrionic

an advanced new concept for assuring ideal "indoor weather" with utmost accuracy, utmost simplicity. Developed by Barber-Colman Company, "Electrionic" control systems combine the rapid response and superior performance of electronic sensing with dependable, long-lived, positive-positioning electric motor operators. "Electrionic" control systems are individually designed to incorporate control center technique for better installation, graphic illustration, remote temperature adjustment and indication. Mark it well in your mind! "Electrionic" — the modern approach to the control of heating and air conditioning. Write today for your copy of "Better Control — Electrionically."

BARBER-COLMAN COMPANY
Dept. O, 1301 Rock Street, Rockford, Ill.



Ducts lined with L·O·F Glass Fibers' Microtex are easy to fabricate and install; offer maximum insulation per dollar.

L·O·F Glass Fibers' Microtex duct liner gives 3-way protection, even at peak air velocities

For more efficient, 3-way insulation . . . under *all* operating conditions . . . at low cost, specify L·O·F Glass Fibers' Microtex duct liner. Fine glass fibers absorb mechanical noises; insulate warm- and cold-air ducts against heat transfer. Duct itself acts as a vapor barrier. Sprayed facing resists air erosion, even at top operating velocities.

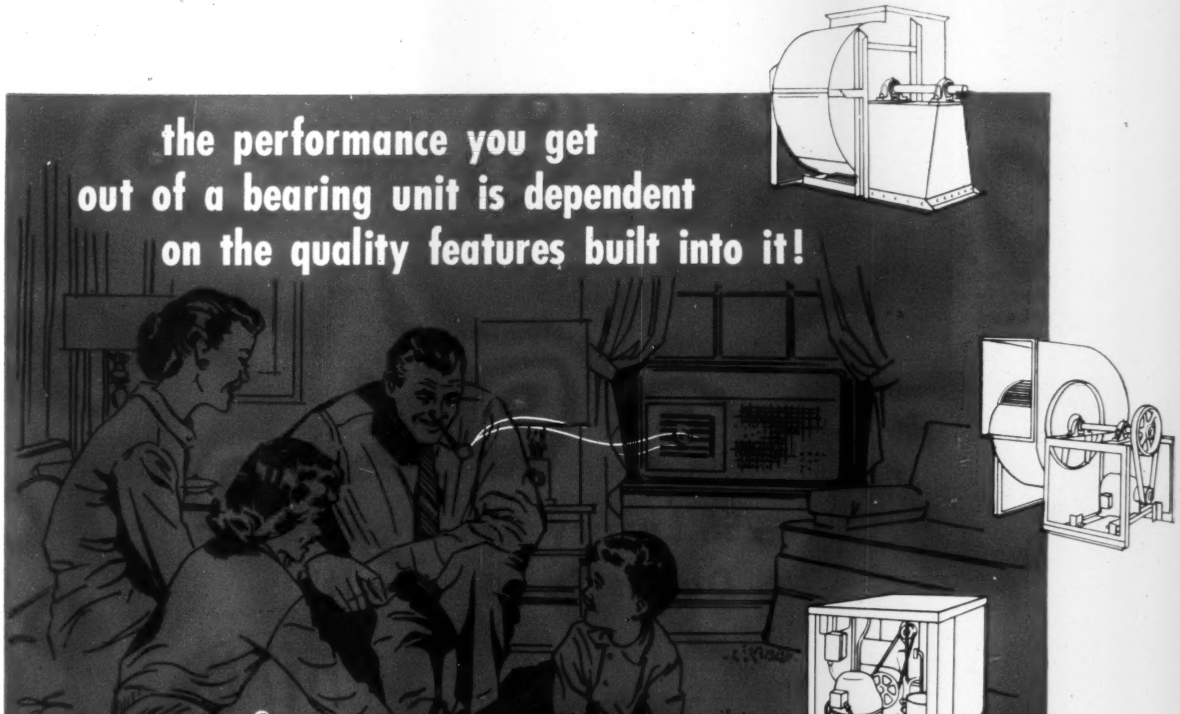
Economical Microtex provides maximum insulation per dollar. Applied quickly with adhesive and formed with the duct in the brake, Microtex requires no special skills, tools or equipment. Can be easily cut and fitted into irregular sections. Available in 1½, 2, and 3 lb./cu. ft. densities, coated with black vinyl, Microtex is:

- strong
- permanent
- lightweight
- fire-resistant
- resilient
- pleasant to handle

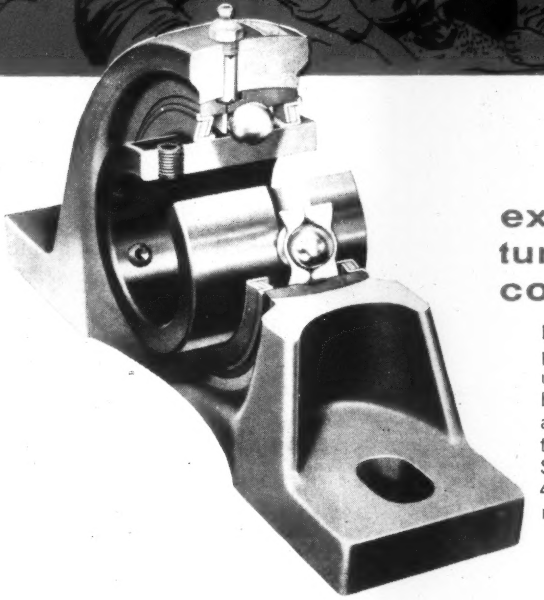
Get the facts on high-efficiency, low-cost Microtex duct liner. Contact our distributor, or write: *L·O·F Glass Fibers Company, Dept. 39-37, 1810 Madison Avenue, Toledo 1, Ohio.*

L·O·F GLASS FIBERS

L·O·F GLASS FIBERS COMPANY • TOLEDO 1, OHIO



the performance you get out of a bearing unit is dependent on the quality features built into it!



SEALMASTER'S

exclusive combination of features assures smooth, quiet, continuous performance!

No component used in air conditioning equipment today plays a more vital role in its performance than the bearing units carrying the load. SEALMASTER's exclusive combination of engineering features provides a decided advantage recognized by most of the leading manufacturers in the field. These features are available on the SEALMASTER standard line of pillow blocks, 2- and 4-bolt flange and cartridge units and a line of rubber mounted units.

Write for
Bulletin 454

ZONE HARDENING assures positive race to shaft holding power, minimizing vibration, eliminating shaft wear and reducing fretting corrosion.

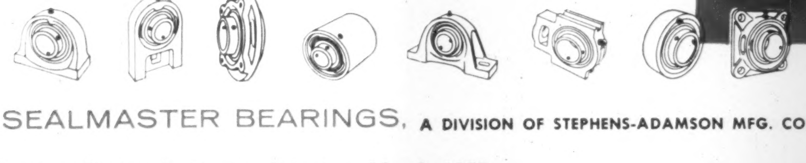
LAND RIDDEN BALL RETAINER traps grease and prevents "churning."

LABYRINTH SEAL keeps dust and dirt out, lubrication in.

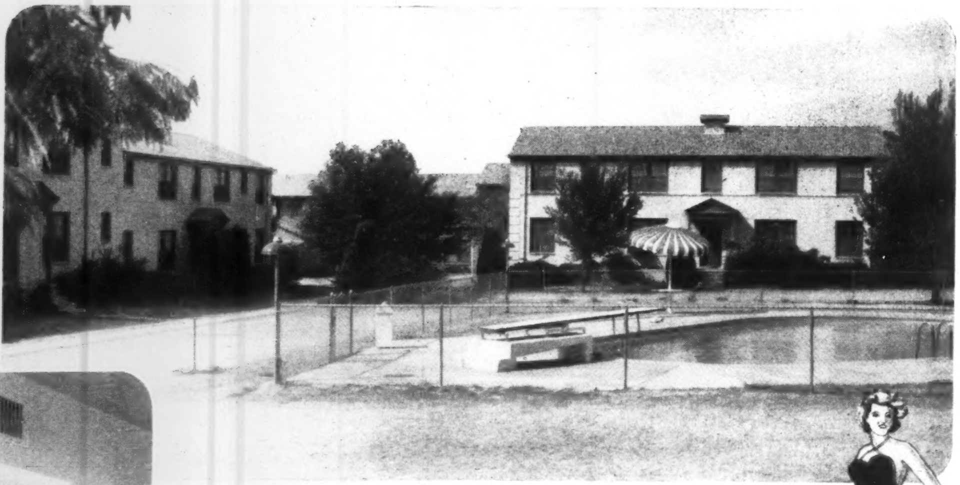
LOCKING PIN AND PERIMETER DIMPLE prevents creep or spin of outer race ring in housing, eliminating housing wear, but permitting alignment of shaft and bearing unit.

SEALMASTER

BALL BEARING UNITS



SEALMASTER BEARINGS, A DIVISION OF STEPHENS-ADAMSON MFG. CO., 47 RIDGEWAY AVENUE, AURORA, ILL.



Hide-a-way air conditioner is mounted above hallway

256 Luxury Apartments near Dallas Equipped with

TRADE **FRICK** MARK®

Air Conditioning

The Woodlane Apartments comprise 18 buildings, covering four city blocks. Built and operated by Corrigan Properties, Inc., they offer year-'round air conditioning, among other attractions; people wait for a chance to rent them.

Beatty Engineering Co., Frick Air Conditioning Contractors in Dallas, designed and installed the year-'round system. Four Frick "ECLIPSE" compressors furnish 400 tons of refrigeration. Both the owners and occupants are much pleased with results.

You, too, will be pleased with Frick equipment—whether for air conditioning, ice making, quick freezing or other refrigerating work. Get bulletins and estimates now: write

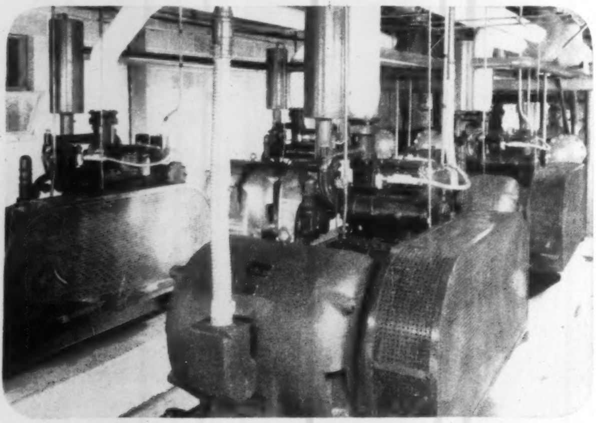
DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA., U. S. A.

Also Builders of Power Farming and Sawmill Machinery

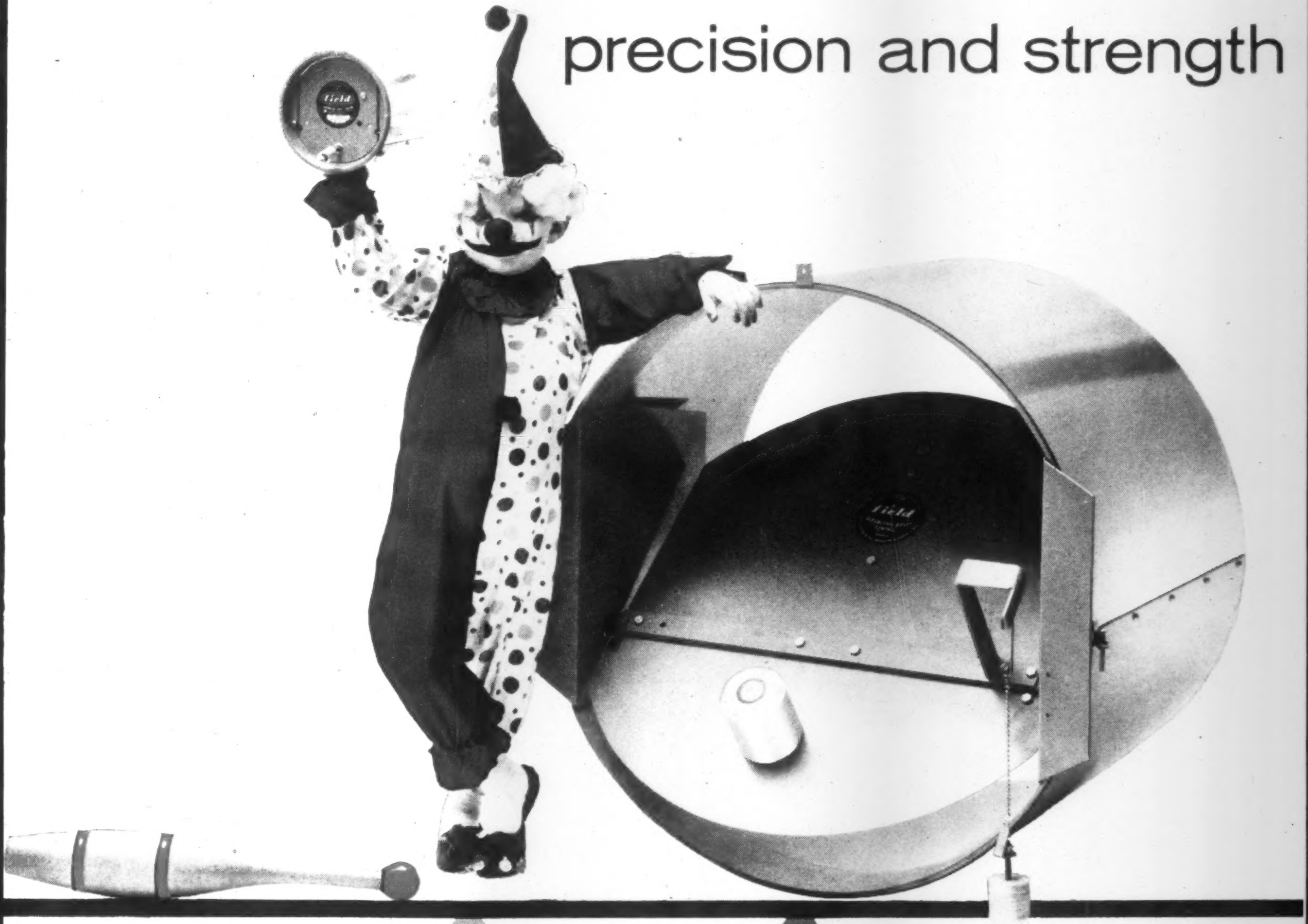
Building housing refrigerating system has cooling tower, with fans, on roof

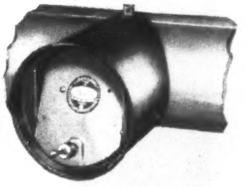


Frick "ECLIPSE" compressors cooling 256 Woodlane Apartments

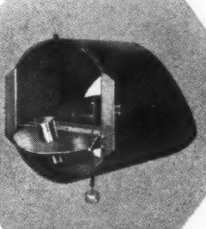
midget or GIANT

Field draft controls provide both precision and strength

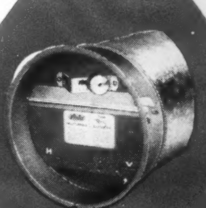




SIZES
6″ THRU 32″
Field "M" Controls for oil and coal fired domestic, commercial and industrial heating plants



SIZES
8″ THRU 32″
Field "MG" Double-Acting Controls for gas fired commercial and industrial heating plants



SIZES
6″ THRU 9″
Field "RC" Controls for domestic oil and coal fired heating plants, for flue sizes 5″ through 10″

FIELD CONTROL DIVISION
of H. D. Conkey & Company, Mendota, Ill.
AFFILIATES:
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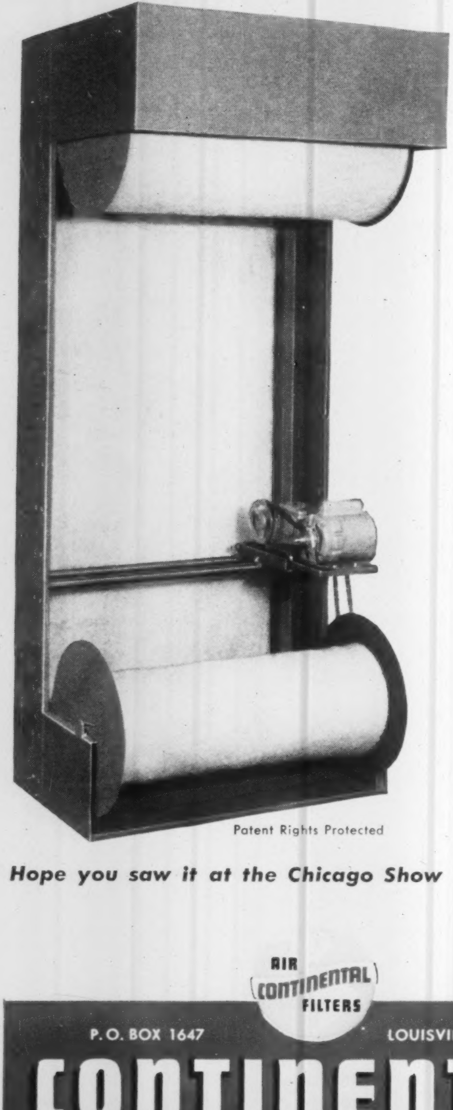
CONTINENTAL'S

AUTOMATIC ROLL-AWAY AIR FILTER

clears the air...



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Hope you saw it at the Chicago Show

Dependability and economy of operation are the outstanding features of this new automatic viscous air filter. Engineered to reduce moving parts to a minimum and eliminate possible causes of stoppages.

Provides largest effective filter area for overall height and width of any corresponding filter.

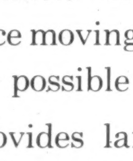
Maintenance costs lowest per CFM in its class.

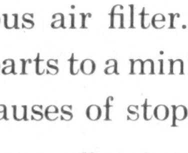
Continental representative in your area will gladly provide complete information . . . or write:

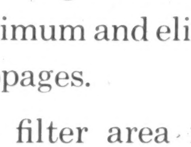
AIR CONTINENTAL FILTERS

P. O. BOX 1647 LOUISVILLE 1, KY.

CONTINENTAL AIR FILTERS Inc.

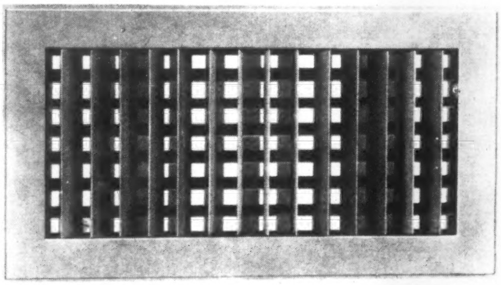






THE U.S. MULTIFLEX is the LEADER in SILENT PERFECT AIR HANDLING

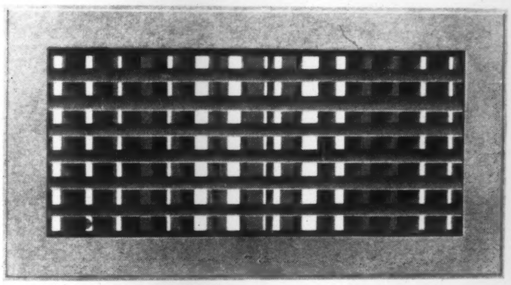
SPECIFY NO. 190 SERIES ON DELUXE AND ALL CLASSES OF COMMERCIAL SYSTEMS



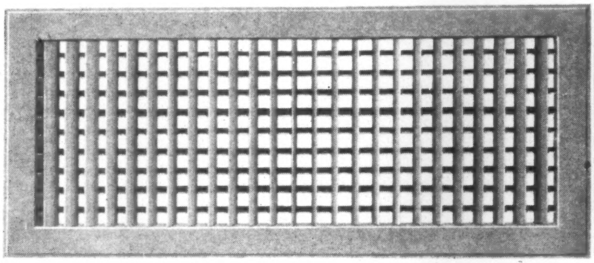
No. 190 U. S. MULTI-FLEX REGISTER

No. 190 U. S. Multiflex Air Conditioning Registers provide the Utmost in SILENT AIR DISTRIBUTION. Opposed Valves with NEW SCREW DRIVER Operation. NO LOST KEYS. Air Volume Positively Controlled by Screw Driver Adjustment.

No. 191 U. S. Multiflex performs with the same silentness and other features of No. 190. Positions of grille bars are simply reversed.

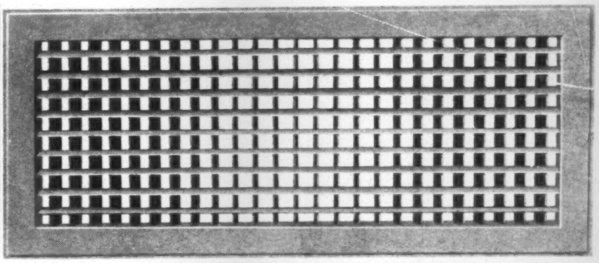


No. 191 U. S. MULTI-FLEX REGISTER



No. 193 U. S. MULTI-FLEX GRILLE

Has Double Bank of Deflector Bars to match the No. 190.



No. 194 U. S. MULTI-FLEX GRILLE

Has Double Bank of Grille Bars to match the No. 191.

The BEST! U. S. MULTIFLEX REGISTER Lines are the LOWEST COST, HIGHEST QUALITY of ALL Air Conditioning Registers - and Grilles. It will pay you to INVESTIGATE!

WRITE FOR LATEST CATALOG AND COMPLETE SPECIFICATIONS

UNITED STATES REGISTER COMPANY

BATTLE CREEK, MICHIGAN
MINNEAPOLIS • KANSAS CITY • ALBANY

tall,
light and
cool!

Efficiency begins, according to experts, with comfortable surroundings. Los Angeles' Tishman Building offers its fortunate occupants the utmost in cool comfort, thanks to the use of Utility Blowers in the air conditioning system.

Manufacturers of heavy and standard duty blowers for heating, air conditioning and ventilating installations. Producers of blowers and blower parts for original equipment manufacturers. Write for catalogue data.

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FAN CORP.
911 EAST 59th STREET
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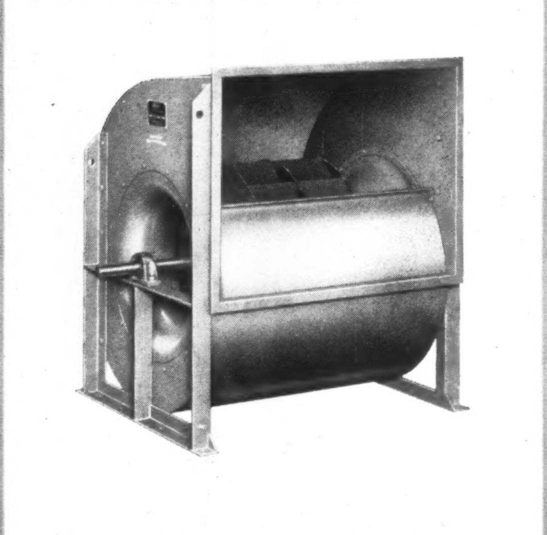
A DIVISION OF
UTILITY APPLIANCE CORP.



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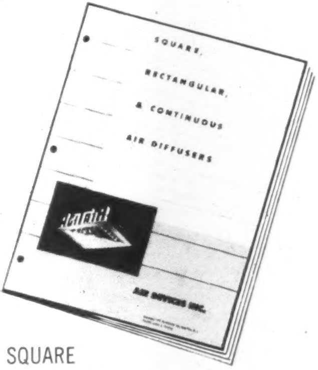

SQUARE,
RECTANGULAR,
& CONTINUOUS
AIR DIFFUSERS
AIR DEVICES INC.

① SQUARE RECTANGULAR & CONTINUOUS AIR DIFFUSERS

AGITAIR
PRESSURE TERMINALS
AIR DEVICES INC.

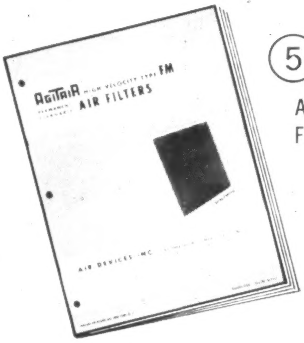
② HIGH PRESSURE TERMINALS

ANOTHER
AGITAIR

③ CIRCULAR DIFFUSERS

AGITAIR
STRIPLINE
AIR DIFFUSERS

④ STRIPLINE SLOT DIFFUSERS


AGITAIR
FM
AIR FILTERS
AIR DEVICES INC.

⑤ AIR FILTERS

AIR DEVICES INC.
185 MADISON AVE. NEW YORK 16, N. Y.
Air Diffusers • Filters • Exhausters

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1 2 3 4 5

NAME____________________

FIRM____________________

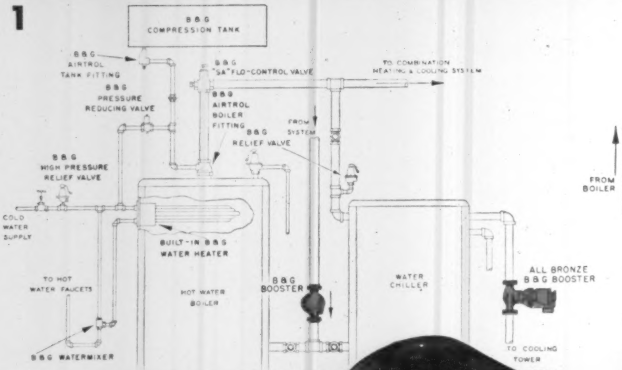
STREET____________________

CITY__________ZONE_____STATE__________

6 WAYS TO MAKE A

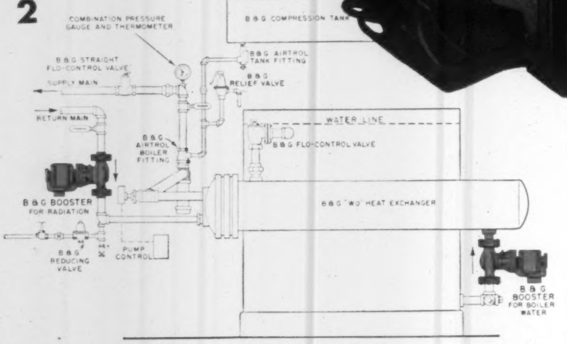
PROFIT ON B&G BOOSTERS

1


B&G COMPRESSION TANK
B&G AIRTROL TANK FITTING
B&G PRESSURE REDUCING VALVE
B&G "SA" FLO-CONTROL VALVE
TO COMBINATION HEATING & COOLING SYSTEM
B&G AIRTROL BOILER FITTING
B&G RELIEF VALVE
FROM SYSTEM
B&G HIGH PRESSURE RELIEF VALVE
COLD WATER SUPPLY
BUILT-IN B&G WATER HEATER
TO HOT WATER FAUCETS
HOT WATER BOILER
B&G BOOSTER
WATER CHILLER
ALL BRONZE B&G BOOSTER
TO COOLING TOWER
B&G WATERMIXER

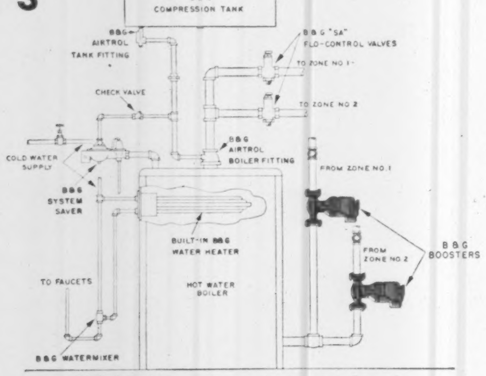
B&G Booster used on combination hot water heating and chilled water cooling system. B&G Booster or Series 1522 Centrifugal Pump can also be used to circulate water from the chiller through the cooling tower.

2


COMBINATION PRESSURE GAUGE AND THERMOMETER
B&G COMPRESSION TANK
B&G STRAIGHT FLO-CONTROL VALVE
B&G AIRTROL TANK FITTING
SUPPLY MAIN
B&G RELIEF VALVE
RETURN MAIN
WATER LINE
B&G AIRTROL BOILER FITTING
B&G FLO-CONTROL VALVE
B&G BOOSTER FOR RADIATION
B&G "WU" HEAT EXCHANGER
B&G REDUCING VALVE
PUMP CONTROL
B&G BOOSTER FOR BOILER WATER

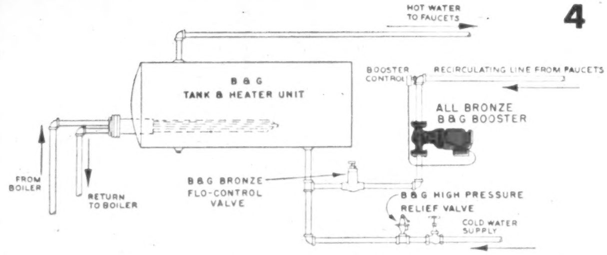
B&G Boosters and "WU" Heat Exchanger provide the means for supplying heat to additional radiators and zones or additional service water heating requirements.

3


B&G COMPRESSION TANK
B&G AIRTROL TANK FITTING
B&G "SA" FLO-CONTROL VALVES
TO ZONE NO 1
CHECK VALVE
TO ZONE NO 2
COLD WATER SUPPLY
B&G AIRTROL BOILER FITTING
FROM ZONE NO.1
B&G SYSTEM SAVER
BUILT-IN B&G WATER HEATER
FROM ZONE NO.2
B&G BOOSTERS
TO FAUCETS
HOT WATER BOILER
B&G WATERMIXER

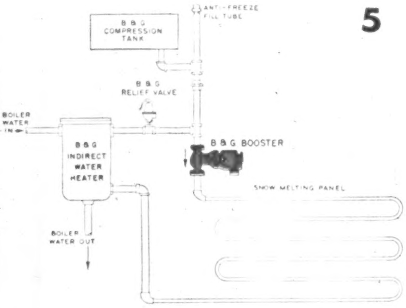
B&G Boosters used on multiple zone forced hot water heating system.

4


HOT WATER TO FAUCETS
B&G TANK & HEATER UNIT
BOOSTER CONTROL
RECIRCULATING LINE FROM FAUCETS
ALL BRONZE B&G BOOSTER
FROM BOILER
RETURN TO BOILER
B&G BRONZE FLO-CONTROL VALVE
B&G HIGH PRESSURE RELIEF VALVE
COLD WATER SUPPLY

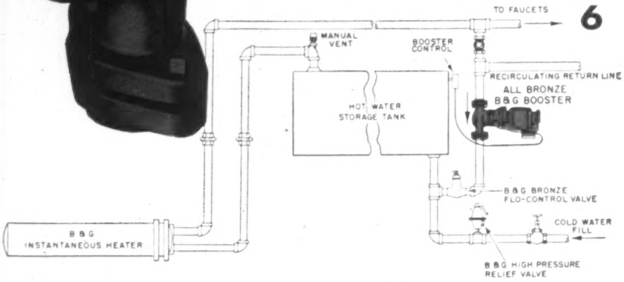
B&G All-Bronze Booster used on recirculating line from hot water faucets maintains hot water at fixtures at all times. Recommended on all installations, particularly those where long plumbing lines are used.

5


ANTI-FREEZE FILL TUBE
B&G COMPRESSION TANK
B&G RELIEF VALVE
BOILER WATER IN
B&G INDIRECT WATER HEATER
B&G BOOSTER
SNOW MELTING PANEL
BOILER WATER OUT

B&G Boosters used to circulate an antifreeze solution through snow and ice melting panels.

6


TO FAUCETS
MANUAL VENT
BOOSTER CONTROL
RECIRCULATING RETURN LINE
ALL BRONZE B&G BOOSTER
HOT WATER STORAGE TANK
B&G BRONZE FLO-CONTROL VALVE
COLD WATER FILL
B&G INSTANTANEOUS HEATER
B&G HIGH PRESSURE RELIEF VALVE

All-bronze B&G Booster used to provide an extra supply of hot water from an undersized boiler. Semi-tankless hook-up maintains initial supply of hot water.

The multiple uses of mechanically circulated water in homes, commercial buildings and industrial plants have made the B&G Booster an outstanding source of profit to contractors.

For new or modernized forced hot water heating systems—for stepping up efficiency in service or process water heating systems, B&G Booster applications are innumerable.

The B&G Booster delivers *greater value*...in *quiet* operation...in failure-proof performance...in long life...all adding up to a solid reputation for dependability. That's why more B&G Boosters are sold than all other similar pumps combined.

BELL & GOSSETT
COMPANY
Dept. ES-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong Ltd.,
1400 O'Connor Drive, Toronto 16, Ontario, Canada

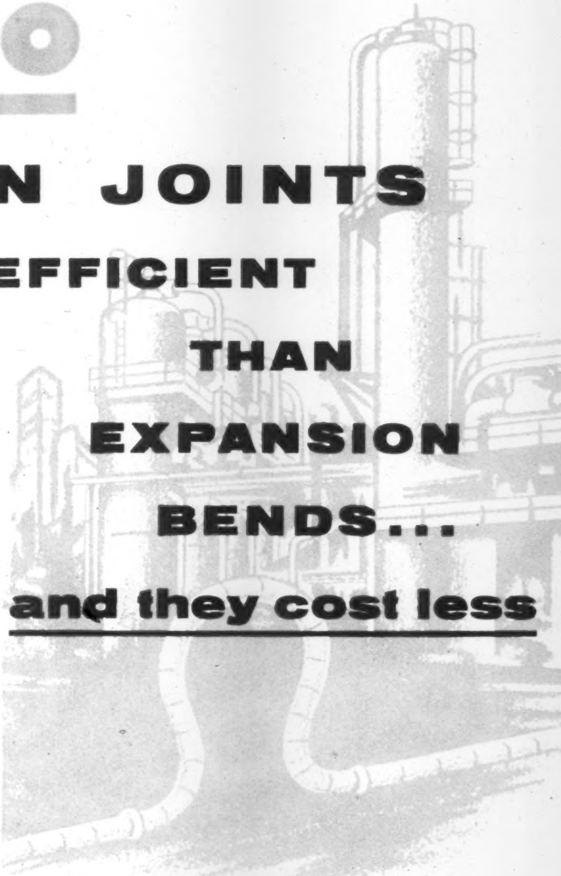
ADSCO

EXPANSION JOINTS

ARE MORE EFFICIENT

THAN EXPANSION BENDS...

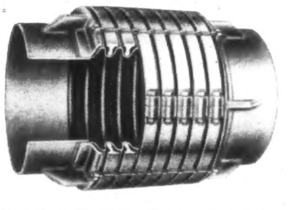
and they cost less



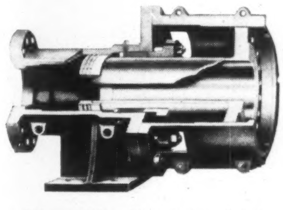
ADSCO Expansion Joints are more efficient than pipe bends for three important reasons:

1. **LESS HEAT LOSS.** A 12-inch line 1000 feet long, carrying steam at 200 lbs. and 550 F, will lose 16% more heat if bends are used instead of ADSCO Expansion Joints.
2. **LESS PRESSURE DROP.** The same line will have a 28% greater pressure drop with bends than with ADSCO Expansion Joints.
3. **LESS SPACE.** One pipe bend requires 100 to 300 sq. ft. of valuable space. An ADSCO Expansion Joint requires little or no extra space.

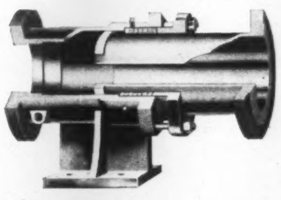
And, in addition, ADSCO Expansion Joints cost less. Used to absorb 4 inches of expansion per 150 feet of 12-inch pipe, an expansion bend, or loop, will cost 50% to 100% more than an ADSCO Expansion Joint. Similar savings can be obtained for other sizes of pipe and for different conditions.



Corruflex Packless Expansion Joint. Requires no maintenance.



Piston-Ring Expansion Joint. Can be unpacked at full operating pressure.



Internally Guided Expansion Joint. Traverses of 4", 8", and 12" per slip.

If you are planning construction of a pipe line, by all means investigate ADSCO Joints. If you already use bends, ADSCO can replace them with joints which will perform better and will still save money.

- *Write for Bulletins 54-10 PR and 35-51 PR*

ADSCO
ENGINEERED
PRODUCTS

AMERICAN DISTRICT STEAM DIVISION
ADSCO INDUSTRIES, INC.
20 MILBURN ST. BUFFALO 12, N. Y.

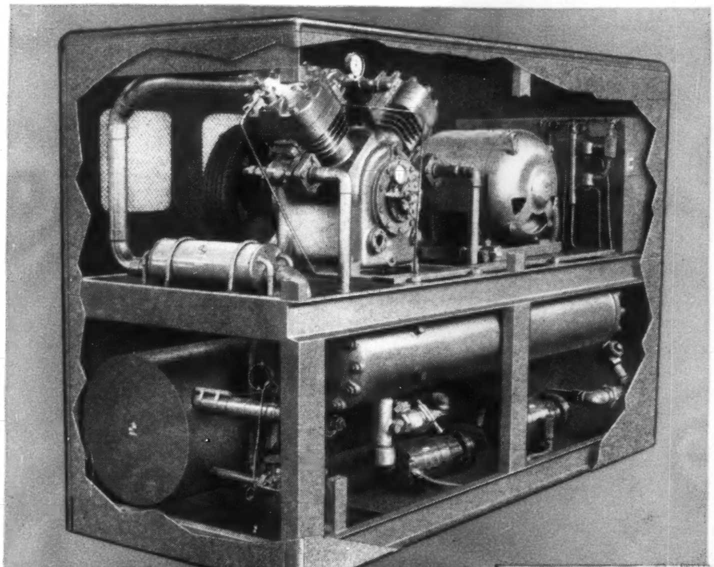
O-B VALVES

a reputation builder . . .

If you pride yourself on installing only quality equipment, you'll want to use O-B bronze valves on every job. "Cheap" or poorly constructed valves can be costly to your reputation.

There is an O-B bronze valve for every job, in low as well as standard pressures. Ask your supplier about them, or write to: OHIO BRASS COMPANY, 380 North Main Street, Mansfield, Ohio.

4727-V



B&G PACKAGE LIQUID COOLER

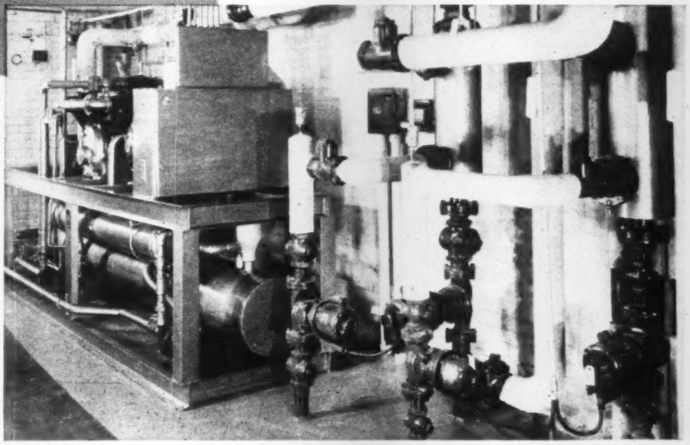
CALL ON B&G WHEN YOU NEED A *Package* LIQUID COOLER OR *Component* PARTS (MANY KEPT IN STOCK FOR FAST SERVICE)

Specifying "B&G" throughout for refrigeration and air conditioning installations assures you of two things. First, equipment which has demonstrated top quality performance for years. Second, a single manufacturer's responsibility for satisfactory operation.

When selecting pumps, B&G Series 1522 units invite your most critical comparison. Of vertical split-case design and equipped with the leak-proof "Remite" Mechanical Seal, its *silent* operation is amazing in a pump of this character. Other B&G centrifugal pumps offer similar features for completely satisfactory performance.

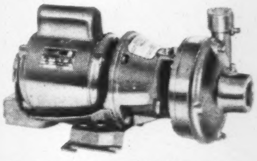
B&G Evaporators and Condensers all offer *plus* values in efficiency designing and rugged, long life construction. They are built to ASME Code requirements.

For a completely integrated and assembled water chiller the B&G Package Liquid Cooler offers many unusual features. Complete description and engineering data is given in new bulletin —send for your copy.

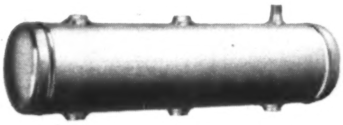


B&G Package Liquid Cooler, Booster Pumps, Flo-Control Valves and other auxiliary equipment used in combination heating and cooling system.

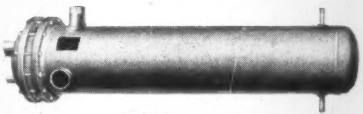
B&G Condenser



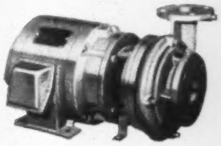
B&G Series 1522 Pump



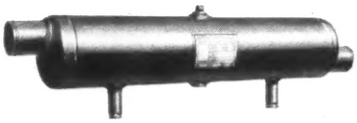
B&G Liquid Receiver



B&G Evaporator



B&G Series 1531 Pump



B&G Heat Exchanger

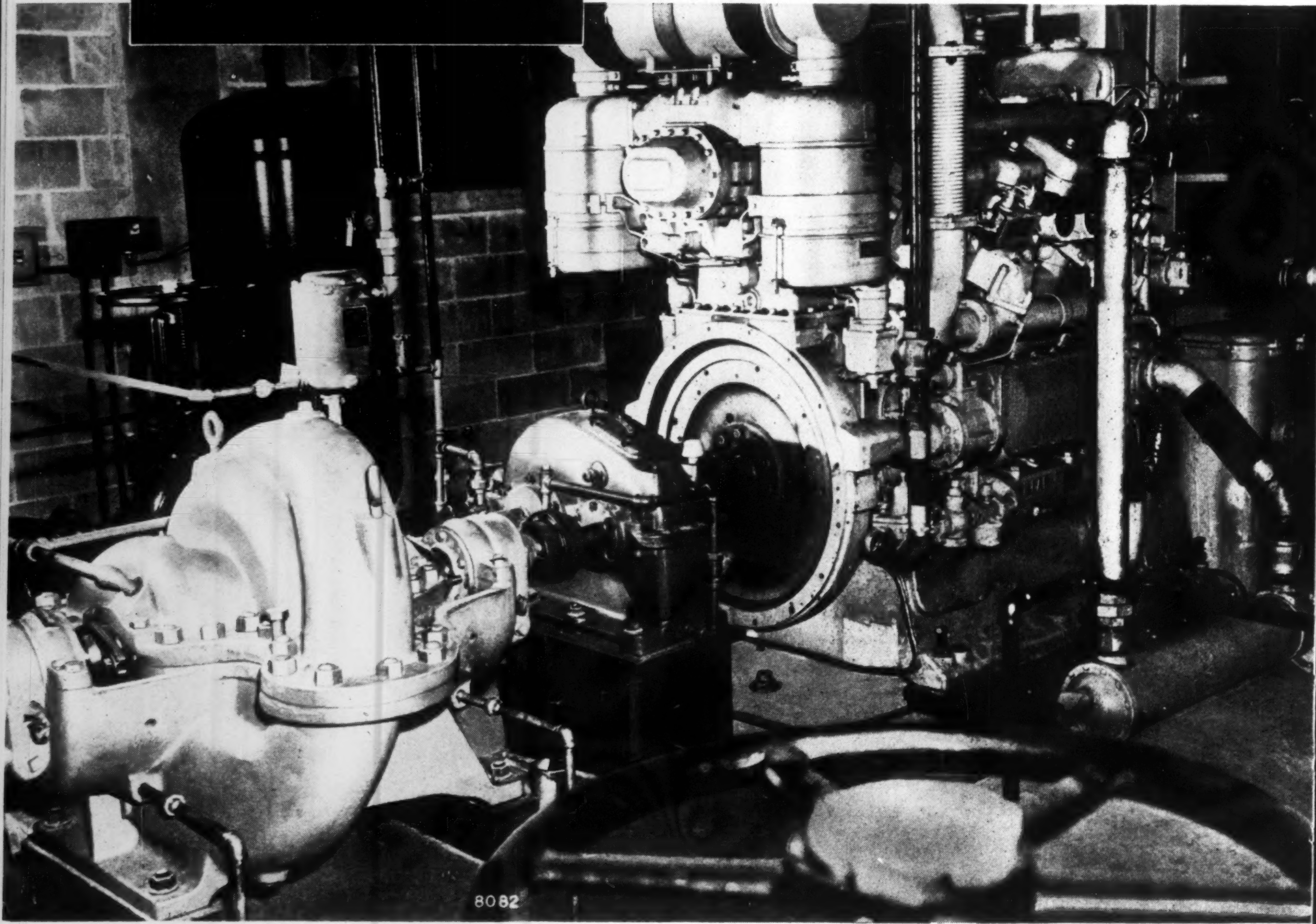
BELL & GOSSETT COMPANY

Dept. RES-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto 16, Ontario, Canada

DE LAVAL
TWO-STAGE CENTRIFUGAL PUMPS

boost pressure at peak loads in Port Washington, New York



This De Laval two-stage horizontal split-case pump is one of a pair used to boost pressure during peak hours in the Port Washington, New York water works. Taking water from a large underground storage tank, these De Laval units maintain pressure throughout the system. The dependable centrifugal pumps are powered by Caterpillar diesels with speed increasers; they deliver 1500 gpm at 400 feet tdh with 15 feet lift requiring 185 bhp.

De Laval 2IS-2KS pumps are designed with • back-to-back impellers for balanced hydraulic thrust • easily replaceable threaded impeller wearing rings • long-life labyrinth case rings • ring-oiled ball bearings—plus ten other important design features. They are available in sizes from 2 inch to 8 inch discharge, for capacities to 3000 gpm and heads to 750 feet. *Write for Bulletin 1501 giving complete data.*

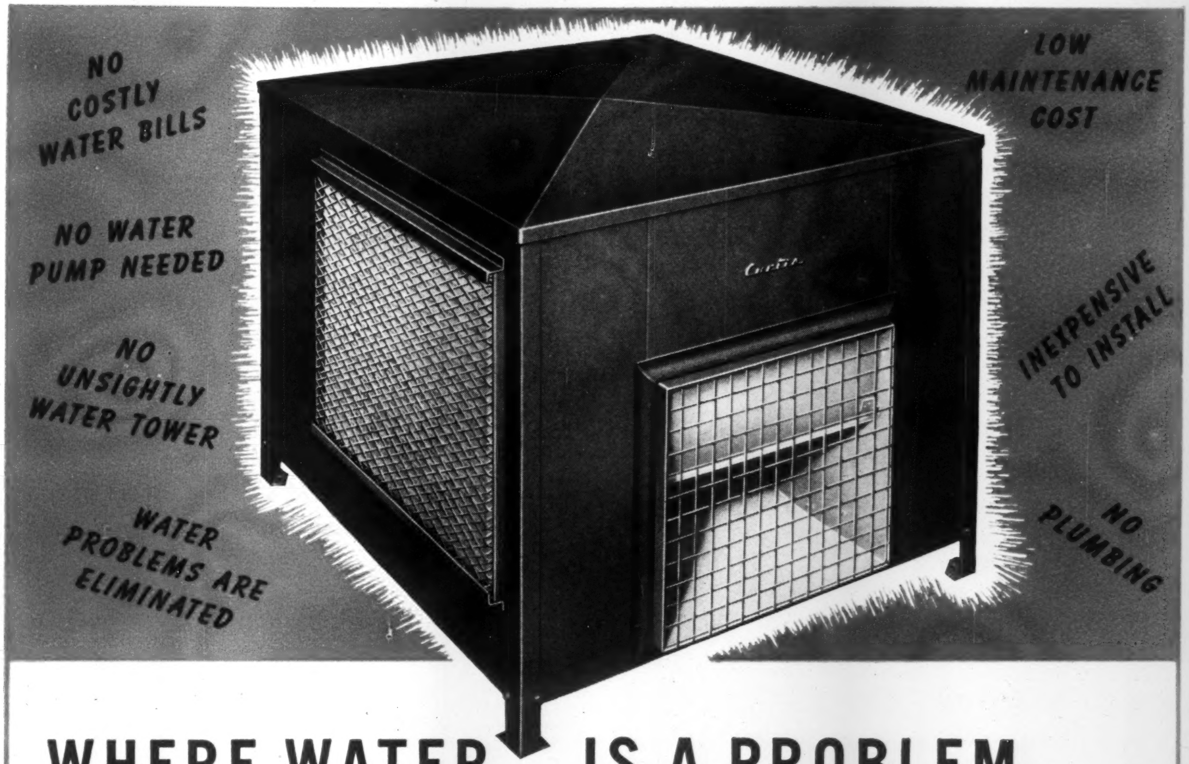
Consulting Engineer
Angus D. Henderson
Westbury, L. I., N. Y.

Contractor
D. Fortunato, Inc.
Floral Park, L. I., N. Y.

DE LAVAL *Centrifugal Pumps*

DE LAVAL STEAM TURBINE COMPANY
871 Nottingham Way, Trenton 2, New Jersey

DL 387


NO COSTLY WATER BILLS
NO WATER PUMP NEEDED
NO UNSIGHTLY WATER TOWER
WATER PROBLEMS ARE ELIMINATED
LOW MAINTENANCE COST
INEXPENSIVE TO INSTALL
NO PLUMBING
Curtis

WHERE WATER IS A PROBLEM

Curtis HAS THE ANSWER

For More Profits . . . More Customer Satisfaction
with NEW CURTIS Waterless Air Conditioning Unit

The new, improved Curtis packaged, waterless, air-cooled air conditioning unit is designed to build sales for *you*—to give *your* customers *more* for their money.

ALL NEW ALUMINUM SHELL will *not* rust, is extremely lightweight, lasts forever.

NEW PERMANENT, COLORWELD FINISH will *not* peel or chip, requires *absolutely no* maintenance.

COVERED BY 5 YEAR PROTECTION PLAN.

COSTS LESS TO INSTALL AND TO OPERATE

No tower required. In majority of jobs, existing duct work can be used. No expensive plumbing needed. No water bills to pay. Does away with *all* water problems.

Every Curtis unit is backed by 103 years of experience and skill. Curtis has a complete, flexible line of air conditioning equipment—nationally advertised to help you sell.

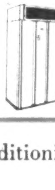
REMEMBER . . . YOU CAN COUNT ON

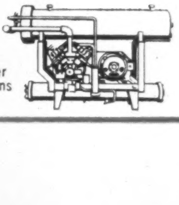
Curtis

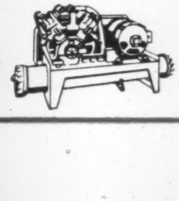
OUR 103rd YEAR

MANUFACTURING COMPANY
REFRIGERATION DIVISION
1950 Kienlen Ave. St. Louis 20, Mo.

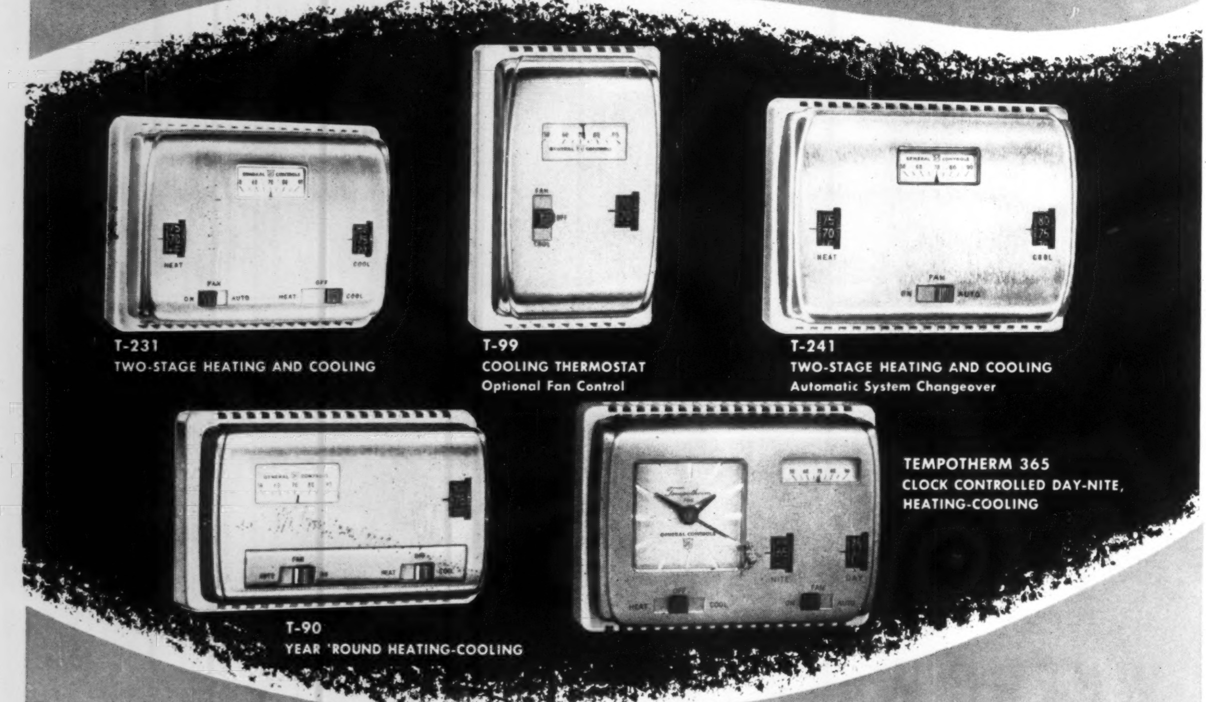
CM-17


Packaged
Air Conditioning Units
3 thru 50 tons


Packaged
Liquid Chiller
7½ to 100 tons


Condensing Units
Up to 100 tons
F-12 or F-22

ALL WITH MODERN MERCURY SWITCH DEPENDABILITY . . .



T-231
TWO-STAGE HEATING AND COOLING

T-99
COOLING THERMOSTAT
Optional Fan Control

T-241
TWO-STAGE HEATING AND COOLING
Automatic System Changeover

T-90
YEAR 'ROUND HEATING-COOLING

TEMPOTHERM 365
CLOCK CONTROLLED DAY-NITE,
HEATING-COOLING

AMERICA'S MOST COMPLETE LINE OF AIR CONDITIONING THERMOSTATS!

118 FUNCTION VARIATIONS TO CONTROL *ANY* SYSTEM

- COOL, HEAT, FAN, AUTO, OFF, RESET SWITCHING FUNCTIONS
- SINGLE OR TWO-STAGE HEATING WITH SINGLE OR TWO-STAGE COOLING
- HEAT AND COLD ANTICIPATION
- DAY AND NITE CLOCK PROGRAMMING
- SINGLE DIAL OR TWO DIAL TEMPERATURE SELECTION
- MANUAL OR AUTOMATIC CHANGEOVER

For control of gas, oil, coal, electricity refrigeration, evaporative, chilled water and heat pump systems.

General Controls continues to set the pace in creating the kind of *advanced design* thermostats that afford the systems engineer maximum selectivity in air conditioning thermostats. Not only do General Controls thermostats please the homeowner by their beauty and simplicity of line, they also signify *quality* — and prove it by delivering the top performance engineered into systems and related equipment.

Consult your nearby General Controls office for complete details on the many air conditioning thermostats available.

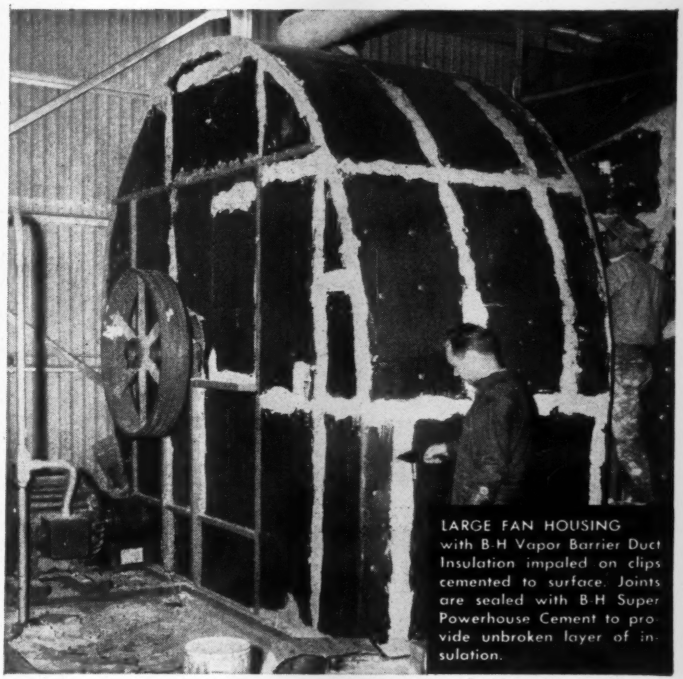
You design it . . . we'll control it . . . *automatically.*

5 basic styles harmonize with any architectural or decorating theme

GC

GENERAL CONTROLS
America's Finest Automatic Controls for Home, Industry, and the Military
Glendale, California · Skokie, Illinois
Five Plants — 40 factory branch offices serving the United States and Canada

for THERMAL and ACOUSTICAL EFFICIENCY put the job up to

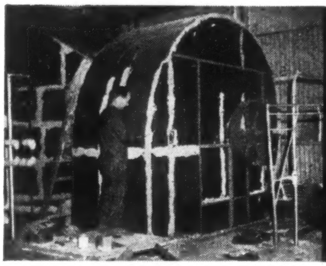


LARGE FAN HOUSING with B-H Vapor Barrier Duct Insulation impaled on clips cemented to surface. Joints are sealed with B-H Super Powerhouse Cement to provide unbroken layer of insulation.

Insulation Contractor:
The Aber Co., Athens, Texas

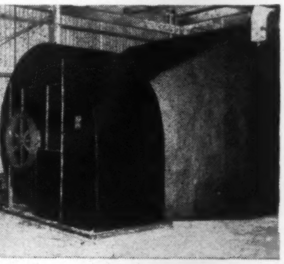
BALDWIN-HILL *Spun Mineral Wool*

DUCT INSULATION

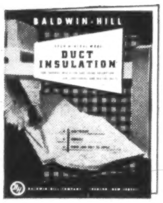


1" wire mesh attached over B-H Duct Insulation preparatory to . . .

Engineering objectives in building this fan housing called for insulation to maintain temperatures of 80° to 90° F. . . . deaden noise . . . and dampen vibration. B-H DUCT INSULATION was selected for its high thermal efficiency, sound and vibration absorption qualities. Also contributing largely to its choice is the ease and low cost of installation. Lightweight, semi-rigid, resilient sheets are easily cut to irregular shapes; bend readily around large radii without breaking and necessity of scoring; are non-irritating to handle; and are moisture and corrosion resistant.



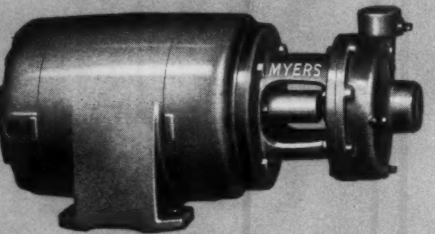
. . . trowelling on ¼" coat of asphalt emulsion for a final protective coating.



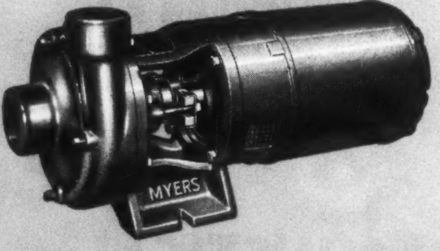
Send for literature describing B-H DUCT INSULATION and giving suggested methods of application. For other B-H insulating products, see Sweet's Engineering File.

BALDWIN-HILL COMPANY
1703 Breunig Avenue Trenton 2, New Jersey
Kalamazoo, Mich. . . . Huntington, Ind. . . . Temple, Tex. . . . Wabash, Ind.

Model 150 M Model 200 M
Shown with rotary seal
(available with stuffing box)

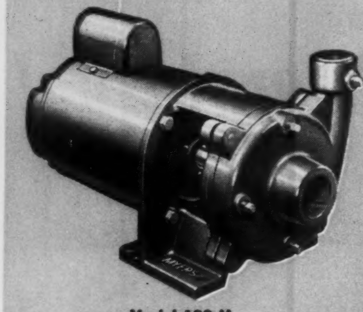


Model 125 M Model 150 M
Shown with stuffing box
(available with rotary seal)

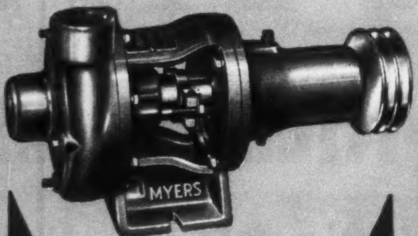


98 MODELS

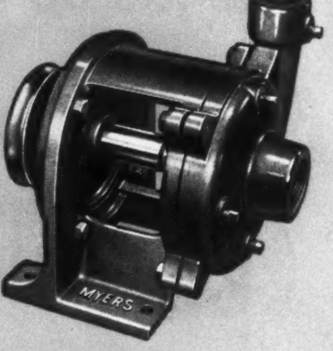
of Myers Centri-Thrift Pumps for air conditioning



Model 100 M
Rotary seal only



Model 125 B
Model 150 B
Model 200 B
Shown with stuffing box
(available with rotary seal)



Model 100 B
Rotary seal only

CHOICE OF MOTORS—Single or three phase, single or dual voltage, open or enclosed.

WIDE SELECTION OF SIZES—1" x 1¼", 1¼" x 1½", 1½" x 2", 2" x 2½", threaded discharge and suction. ⅓, ½, ¾, 1, 2, 3, 5 and 7½ horsepower, motor-mounted or belt-driven.

CHOICE OF SHAFT SEALING—Regularly fitted with rotary seal. Stuffing box may be specified on "125", "150" and "200" models.

WIDE RANGE OF CAPACITIES AND HEADS—Capacities to 240 GPM. Heads up to 140 feet.

OUTSTANDING QUALITY FEATURES

- All-bronze impeller, accurately balanced for smooth operation.
- Removable bronze wearing rings, easily replaced for longer pump life.
- Corrosion resistant, stainless steel shaft for trouble-free service.

Write today for Bulletin 210 on Myers Centri-Thrift Pumps

Myers® PUMPS WATER SYSTEMS AND WATER CONDITIONERS

The F. E. Myers & Bro. Co., Ashland, Ohio • Kitchener, Ont.

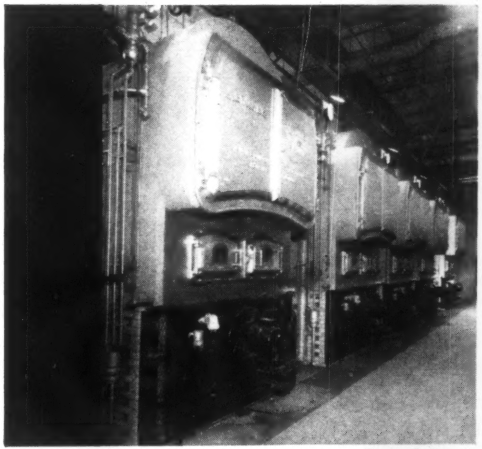
your
visiting facts
and
figures department

A KEWANEE PROPOSAL FOR

Better Homes
Newsweek

Kewanee Boilers are advertised regularly to your customers in national publications.

your
KEWANEE
man



Singly and in battery Kewanee Type C Steel Boilers have won a reputation for high capacity and efficiency—within a minimum floor space—since introduction in 1928.

Job planning and your installations can only be as good as the information behind them. Knowing this, your Kewanee man is data-conscious. He keeps you armed with boiler facts and figures . . . sees that you have an up-to-date catalog . . . is fast to supply specific information you request.

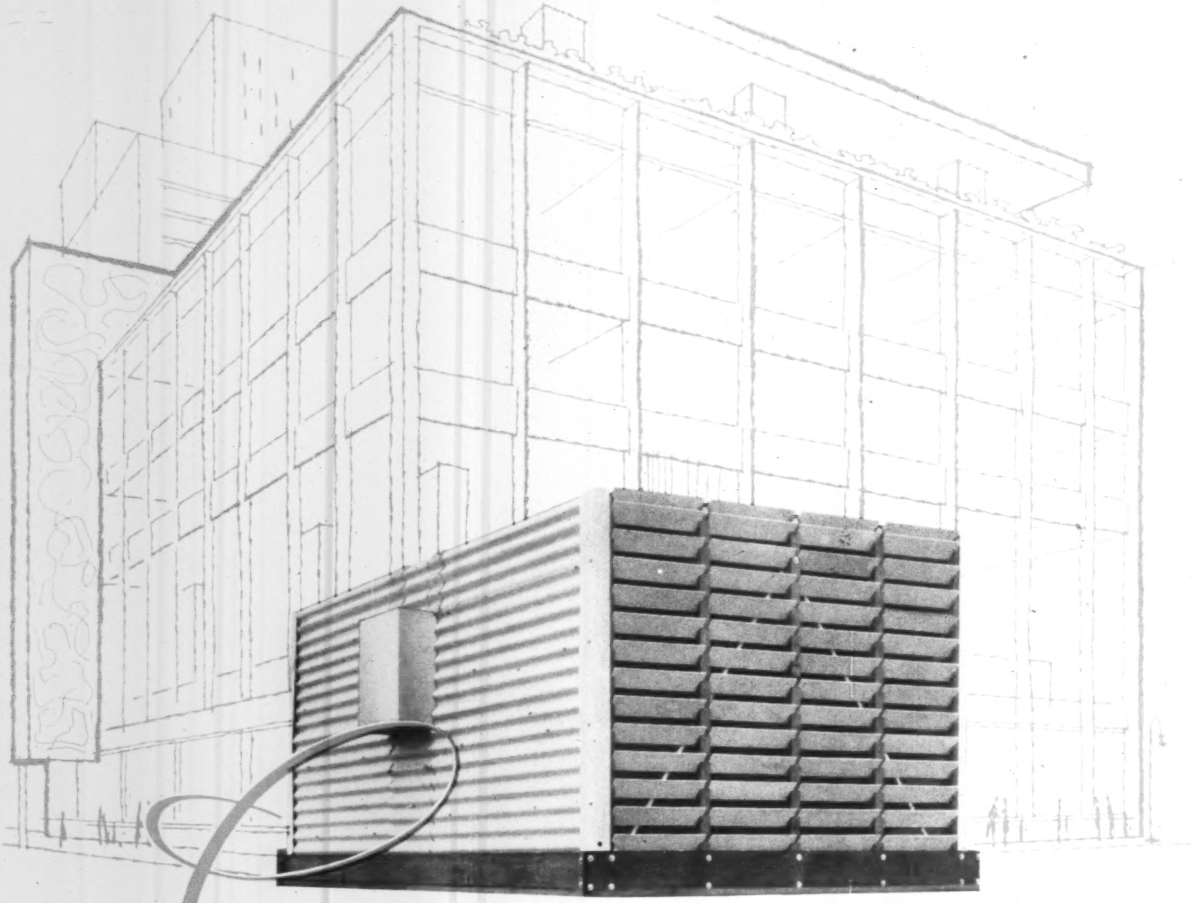
He can intelligently assume this responsibility because he is a qualified boiler specialist. He knows boiler problems—and answers—from years of experience. Also, he maintains close contact with engineering experts at Kewanee Boiler Division—can keep you abreast of latest applications in the field.

His competence keeps pace with the famed performance of Kewanee Boilers themselves—dependable, efficient models from residential 70,000 Btu units to industrial boilers carrying a 651 h.p. rating. And he is quickly available from a nearby Kewanee Branch Office in the coast-to-coast network.

AMERICAN-STANDARD, KEWANEE BOILER DIVISION, 101 Franklin Street, Kewanee, Illinois.

AMERICAN-Standard

KEWANEE BOILER DIVISION



DOUBLE-FLOW AQUATOWERS* ARE *Complete...*

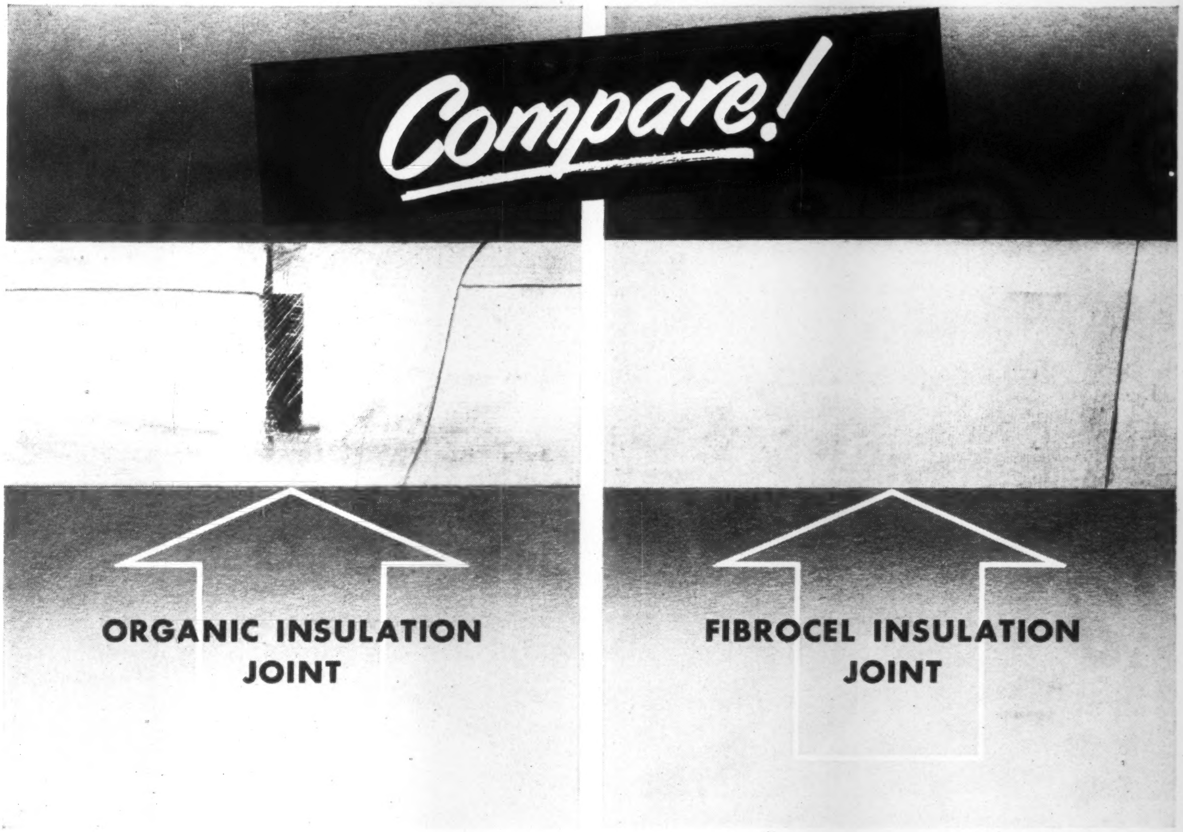
When reviewing submittals on intermediate capacity cooling towers it pays to make certain that all essential elements are included. For example, do they include such vital tower components as diffusion decking . . . drift eliminators . . . access doors . . . adequate fan cylinders? Without these basic parts, no tower can be complete.

When you receive submittals on Marley Double-Flow Aquatowers, you can automatically be sure that "it is all there" — that there is nothing extra to buy. Every cooling tower component that contributes to better performance, greater economy and simpler maintenance is *standard equipment* on Double-Flow Aquatowers.

The performance you get out of your cooling tower depends on what goes into its design and construction. In a Marley Double-Flow Aquatower, there is no compromise with quality, no "shortcuts" that prove expensive in the long run. That's why the Double-Flow Aquatower is the overwhelming first choice of architects, contractors, engineers and owners who require commercial or institutional water cooling equipment.

*Registered Trade Names
*U.S. Pat. No. 2776121

The Marley Company MARLEY Kansas City, Missouri



Joints are shown after exposure to high humidity and hot-pipe drying action under identical test conditions.

Shrinkage test proves joints *stay tight* with J-M FIBROCEL® Insulation

ONLY FIBROCEL OFFERS ALL THESE ADVANTAGES

No shrinkage—eliminates gaping joints. **Resists compression**—retains full-wall thickness. **Uniform dimensions**—precision formed for exact fit. **Economical application**—lightweight, easy to cut with a knife. **Thermally effective. Permanent**—flame, rot, odor and vermin proof. Developed by Johns-Manville Insulation Research.

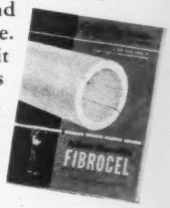
A new molded silica insulation developed for plumbing, heating, chilled water and dual service applications in the 35F to 300F temperature range

Fibrocel completely eliminates objectionable shrinkage caused by atmospheric changes!

Tests prove it won't shrink even after moisture exposure and prolonged service under continuous steam flow. This means Fibrocel joints stay tight, with no unsightly gaps . . . messy patching . . . or costly heat loss—ever!

Fibrocel speeds installation, too! It is light in weight and a pleasure to apply. It cuts cleanly, easily with a knife. And its firmness and remarkable dimensional uniformity assure tight, smooth joints . . . and an overall finished appearance that's as neat, round, and true as the pipe itself.

For complete information on Fibrocel—get your free copy of the new 8-page folder, IN-155A. It includes physical properties, insulating characteristics, sizes and thicknesses available. Why not send for it today. Address Johns-Manville, Box 14, New York 16, New York. (In Canada, Port Credit, Ontario.)



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Johns-Manville *first-in* INSULATION

MATERIALS · ENGINEERING · APPLICATION

Heating and air conditioning, Salt Lake City, Utah

Cold storage piping, Bakersfield, California

Snow melting system, Syracuse, New York

Outdoor ice rink, Hamtramck, Michigan

Water and gas lines, Wyoming Desert

Radiant heating system, Plainview, Texas

. . . and in thousands of other installations, too

SPANG®

QUALITY-CONTROLLED CW STEEL PIPE

GIVES TOP-QUALITY SERVICE

. . . because SPANG Pipe is

—made from top-quality steel

—pre-heated, formed and welded under close control

—descaled to provide a smooth finish

—sized and straightened to give uniformity

—rigidly tested and inspected to assure *top-quality*

A *top-quality* product like SPANG CW saves installation time—saves on construction costs, too. Let SPANG CW Steel Pipe help you make *top-quality* installations. Your local SPANG Distributor will be glad to serve you.

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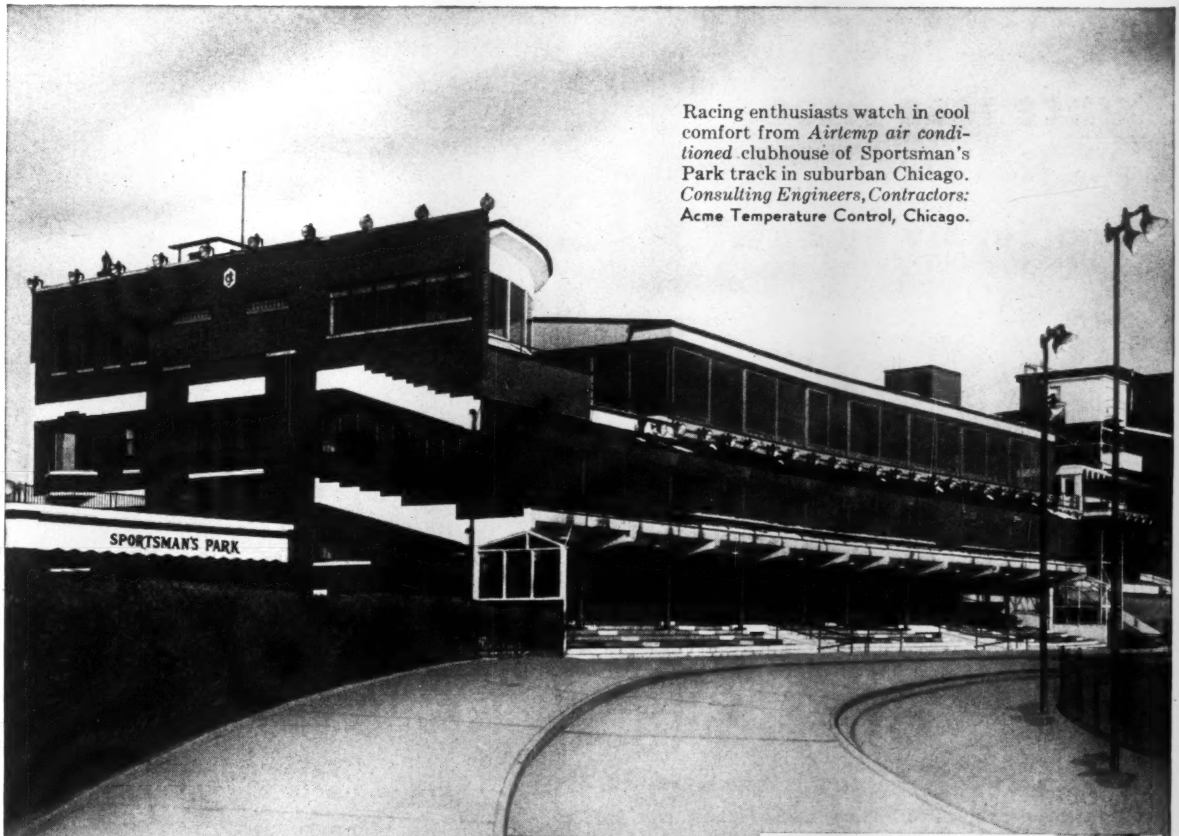
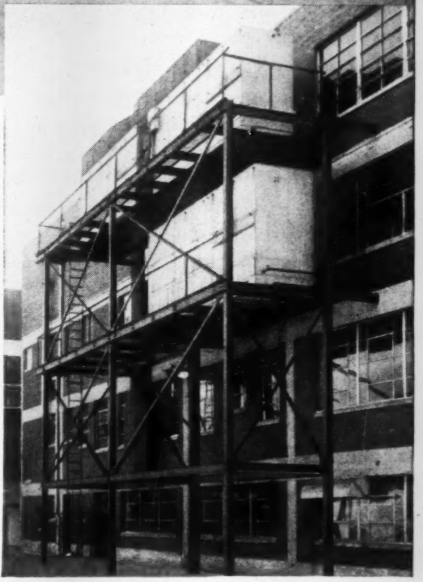
DIVISION OF THE NATIONAL SUPPLY COMPANY

General Sales Office: Two Gateway Center, Pittsburgh, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis

SPANG CW STEEL PIPE



Racing enthusiasts watch in cool comfort from *Airtemp air conditioned* clubhouse of Sportsman's Park track in suburban Chicago. *Consulting Engineers, Contractors:* Acme Temperature Control, Chicago.



Airtemp The SURE WINNER at Sportsman's Park...

Cooling with minimum installation time and cost is a sure thing —with Airtemp "packaged" air conditioning. It can be used with or without ductwork...to cool either single areas, or multi-story complete buildings, like the Sportsman's Park clubhouse.

Another example of how Airtemp's *complete* line—286 models, biggest selection of any manufacturer—helps American business and industry solve cooling problems with models specifically suited to particular requirements—at *standard-model cost!* And all engineered by Chrysler.

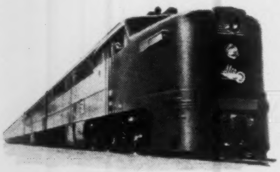
Outside-mounted Airtemp units—1 60-ton Model 2660, and 2 40-ton Models 2640—*silently* and *unseen* cool the 160,000 cubic foot clubhouse. Evaporative condensers totally eliminate need for cooling towers, drastically reducing installation and maintenance expense.

Airtemp
CONSTRUCTION
DIVISION OF
CHRYSLER CORPORATION

PHONE your nearby Airtemp contractor. He's in the Yellow Pages. Or—write to Airtemp Construction Division, Chrysler Corporation, Dayton 1, Ohio.

A CHRYSLER DIVISION SPECIALIZING IN AIR CONDITIONING FOR EVERY HOME AND BUSINESS NEED

SINCE 1888 ALCO Has Said: "Steam Supply by B&W"



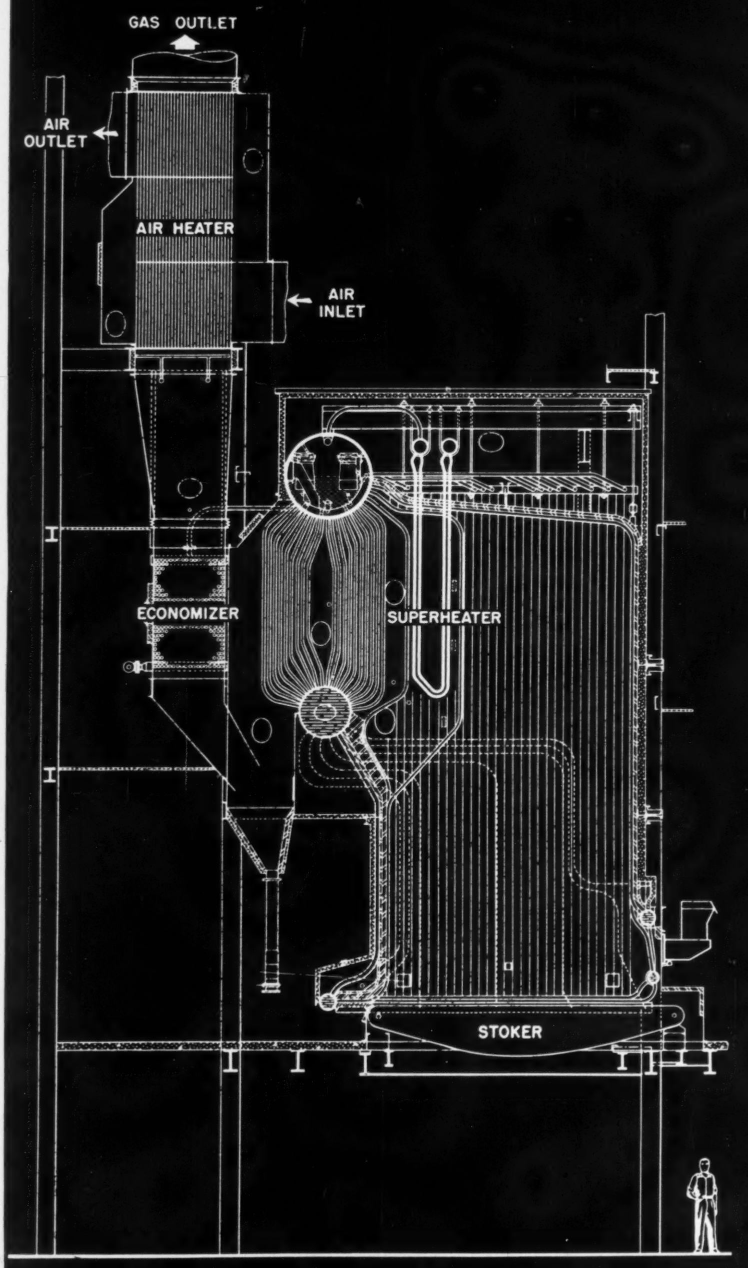
Back in 1888, when the *American Type* locomotive was setting speed records on passenger runs, B&W sold its first boiler to Schenectady Locomotive Works, predecessor of ALCO Products, Inc., to serve the plant.

In January 1955, two more B&W Two-Drum Stirling Boilers went on the line at the company's Schenectady plant. They are providing 100,000 lb of steam per hour for heating, for driving plant auxiliaries, and for some power generation. They bring the number to 40 B&W boilers in ALCO and its predecessors' plants.

What's Interesting about these two latest B&W boilers at ALCO is that they have operated at higher efficiencies than the design contract specified. To ALCO, with its long experience with B&W boilers, this was no surprise.

Long Range, Sustained economy—the product of the top level engineering design found in every B&W boiler—has become something to be expected by long time B&W customers.

More and more manufacturers, in the widest variety of lines, have learned, over the years, to depend upon B&W for an efficient, dependable source of steam. Whatever your steam needs may be—for heating, processing, or power generation—B&W engineers are ready to give you counsel, with nearly a century of steam generation experience behind them. The Babcock & Wilcox Company, Boiler Division, Dept. ME-2, 161 East 42nd St., New York 17, N. Y.



BABCOCK & WILCOX

B&W

BOILER DIVISION

G-771

The Editors' Pages

Central Atomic Heating Plants Coming Soon?

. . . 10 to 15 years says engineer

CENTRAL ATOMIC heating plants for an entire community or a large housing project may not be too far away, according to J. W. James, past president of the American Society of Heating and Air-Conditioning Engineers.

Discussing the nuclear heating plants recently at the start of Crane Co.'s first 1957 commercial heating school at Evanston, Ill., Mr. James said, "Maybe we'll have them by 1966 — maybe by 1970."

Factory Air Conditioning Acceptance Not Far Away

. . . survey shows

MORE FACTORIES in the U. S. will install comfort air conditioning in 1957 than ever before as the industrial cooling trend gains momentum, according to D. C. Minard, president of The Trane Co. Factories will account for the greatest percentage gain in the air conditioning market, it is anticipated.

Less than 1 percent of U. S. factory space is air conditioned at present.

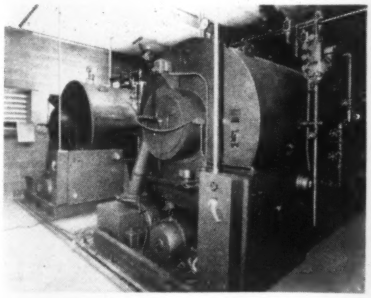
Mr. Minard pointed out that square footage in U. S. industrial plants is 50 times greater than the floor space in office buildings, where air conditioning is now widely accepted. "Obviously," he said, "the market potential here is tremendous once factory air condtioning gains widespread acceptance." Such acceptance may not be far away.

He cited a survey made by a cross section of his firm's 92 regional offices across the nation. The offices queried leading architects and consulting engineers in their areas on the trend toward factory air conditioning for comfort and efficiency of employees.

It was found that the trend was especially rapid in the South, where consulting engineers estimated that 50 percent of all first class factories would be air conditioned by 1960.

It was reported also that the trend was spreading to the North, especially in factories involving high skills.

Factors in the trend include competition for skilled help, the desire to maintain employee efficiency in hot weather, reduce absenteeism, lessen employee turnover, and improve employee morale. ‡



Install Package Boilers At Grand Canyon

. . . decentralize steam system

AT GRAND CANYON national park, the Fred Harvey Co. is currently engaged in a $1 million dollar improvement program to help provide for the ever increasing influx of tourists, according to York-Shipley, Inc.

The old central boiler plant has been abandoned, and new boilers installed, three of which are oil fired packaged steam generators.

"It is believed the decentralization of our steam generating units will, in addition to modernizing an outmoded system, result in considerable economy in annual operating and maintenance expenditures," says Gen. A. E. Henderson, chief engineer of Fred Harvey, Chicago.

Two 100 hp high pressure packaged steam generators now furnish the steam power required by the laundry. A 20 hp steam generator at Bright Angel lodge provides the high pressure — 125 psig — steam required for hotel kitchen cooking.

Each of the three new boilers is a three pass boiler of the Scotch marine type, burning No. 3 fuel oil. They are automatically operated by electrical controls which respond to changes in steam pressure. ‡

"200" Stainless Steels Made 1956 Breakthrough

. . . production up 850 percent

THE YEAR 1956 will be looked on in the stainless steel industry as the breakthrough period for the 200 series of stainless steels when a phenomenal 850 percent production increase was noted over the previous year, according to E. J. Hanley, president of the Allegheny Ludlum Steel Corp.

The 200 series is the chromium-nickel-manganese family of stainless steels, which utilizes about one-half the nickel content of the more familiar 300 series.

The stainless steel industry continued to produce at a near record rate during the year and is expected to ship 680,000 net tons of finished mill products for 1956. This is less than 1 percent below the all time record high set by the industry last year. ‡

Oil Burner Shipments Up 3 Percent Last Year

. . . 1957 outlook favorable

COMMERCIAL-INDUSTRIAL oil burner shipments for 1956 increased by 3 percent over 1955, reports R. H. L. Becker, managing director of the Oil-Heat Institute of America, Inc. Total shipments of the big burners were 36,027.

The outlook for the industry is favorable for 1957, particularly in the fields of schools, institutions, religious and public buildings and, of course, in the huge replacement and modernization markets in commercial and industrial structures, says Mr. Becker. ‡

Sees Piping Color Code Safety Imperative

. . . "keynote for national defense"

COLOR CODING of piping systems is imperative for safety preparedness in case of fire, explosion, or other disaster, according to W. H. Evans, safety engineer, General Electric Co. Quick recognition of the pipe contents is of paramount importance in an emergency, he says.

Furthermore, Mr. Evans believes such color coding should be standardized for greater certainty of identification "to prevent opening or closing the wrong valve."

He points out that a systematic plan for identifying the contents of a piping system has been provided in the *American Standard Scheme for the Identification of Piping Systems,* ASA A13.1-1956. Four basic colors are used for four classifications of piping systems:

F-Fire protection equipment. . . .Red
D-Dangerous materials. . . . . .Yellow
S-Safe materials. . . . . .Green
P-Protective materials. . .Bright blue

The color may be applied to the entire piping system or in bands. Bands should be put at intervals on the pipe and on all sides of the valve. Next to the band should be a legend stating the particular material being piped. It is recommended that for the red or blue code the legend be white on black. For the other color coded lines, the legends should be lettered black on white. It may be desirable also to use arrows showing direction of flow.

In addition to the four basic colors is a fifth, purple, which now designates radioactive materials. Originally, when the code was first formulated in 1928, it meant "extra valuable materials." However, its use was revised in 1956.

Widespread adoption of this standardized color code, says Mr. Evans, may prove to be an important contribution to national defense. ‡

"Master Plan" Trend Up For Air Conditioning

. . . to prevent hodge podge

INCREASING use of the latest concept in air conditioning big buildings—the "master plan formula"—is forecast for 1957 by Thomas Hancock, executive vice president of The Trane Co.

"We see growing indications of acceptance of this sound principle by architects, engineers, and building owners throughout the country," says Mr. Hancock.

The formula provides for a regulated, step by step program whereby large structures can be air conditioned gradually.

Yet, when the entire building is air conditioned, the overall system is completely integrated, resulting in an efficient and economical package.

"One long range program is prepared, even though plans to air condition other areas are two or three years or longer away.

"Then air conditioning is added on a regular basis—zone to zone or floor to floor—each addition part of the carefully thought out plan."

Greater use of this plan, says Mr. Hancock, will help prevent past practices which frequently resulted in a "hodge podge of systems in one building—systems which overloaded water mains and sewers, abused electrical wiring, and conflicted with local water ordinances, making subsequent air conditioning additions or revisions doubly expensive. ‡

Avoid Technical Jargon If You Write to Be Read

. . . cautions new handbook

THE BLANKETING fog of "over-precise, cliche loaded technical jargon" that characterizes much of today's technical copy is under attack by the Minneapolis-Honeywell Regulator Co. It has embarked on a program for good, clear—even unprecise—English, it states in a recently published compact handbook for its technical writers forthrightly entitled, "Why Not Just *Tell* Them?"

The introduction presents this argument on the need for such a booklet: "Everything's changing rapidly nowadays and, unless our writing technique keeps pace, a lot of printed matter is going to get tossed unread into waste baskets.

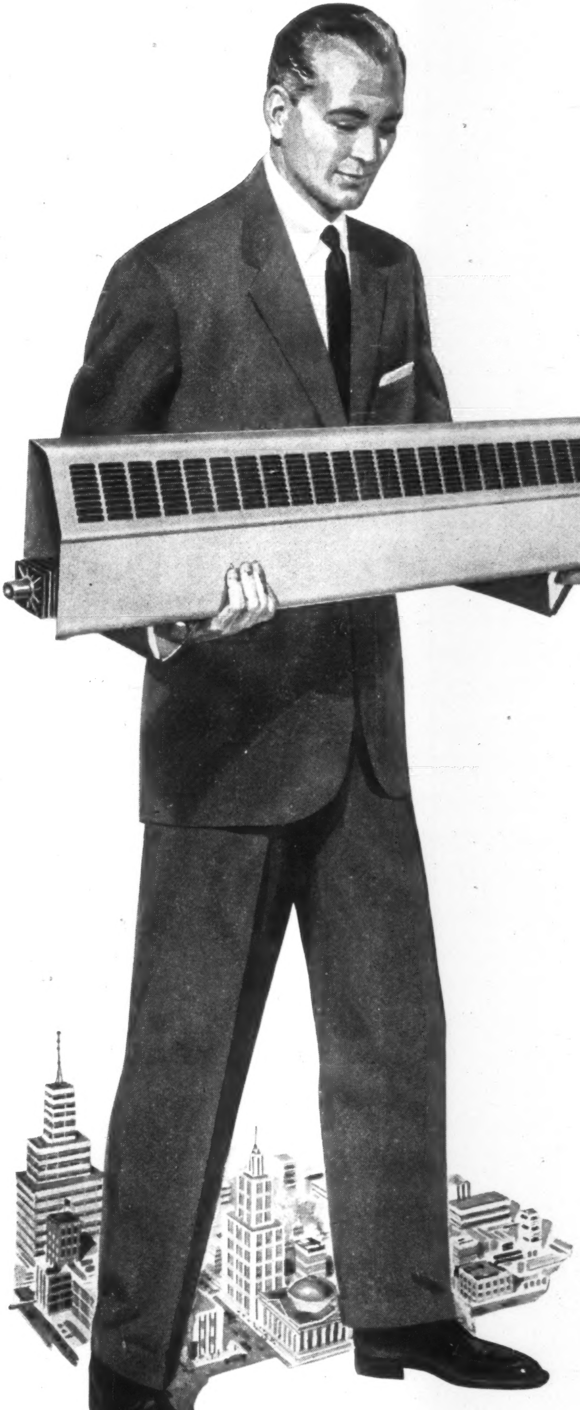
"Don't get the idea that this booklet is intended to bring you up to date on the latest technical jargon. Quite the opposite! It hopes to encourage you to steer clear of both technical jargon and 'engineeringese,' a pompous style of writing that's usually roundabout or timid in stating a general conclusion."

Down to earth tips on how to sharpen and polish technical writing, as well as "Ten Commandments For Technical Writing," are given.

The booklet was prepared by E. A. Murphy, editor of "Instrumentation," external publication of the firm's Industrial Div., in collaboration with John Stahr, editorial director of Carl Byoir & Associates. ‡

"Quote"

"The air of the world will be constantly cleaned and purified in the year 2057 . . . the outdoors will be in the process of being air conditioned."—*Edwin J. Schwanhausser, president, Worthington Corp. in a letter recently deposited in a time capsule on the site of the Built-In-Age Architects Display building, Mountainside, N. J.*



WEBSTER WALVECTOR®

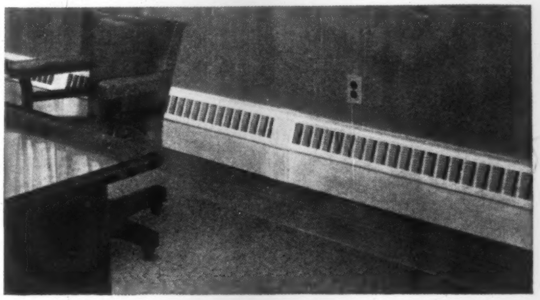
BETWEEN YOU AND WINTER

Yes, Webster Walvector . . . in the hands of your Warren Webster Man . . . is what you need for winter-long heating comfort, in commercial, industrial or institutional buildings . . . anywhere. Webster Walvector blankets every exposed wall with a barrier of clean, uniform, draft-free warmth that keeps winter out, keeps comfort in.

RUGGED—GRACEFUL

For steam or hot water heating, Webster Walvector's graceful, yet rugged modern enclosures with the efficient finned-tube heating elements are available in a wide variety of standard or custom designs to meet your heating need, your architectural requirement. And in back of every Walvector installation is Webster's Finest Product — the Warren Webster Man. Ask him for more details, or write for Bulletin B-1551.

Warren Webster & Company, Camden 5, New Jersey. Since 1888. Offices in 66 principal U.S. Cities and Canada.

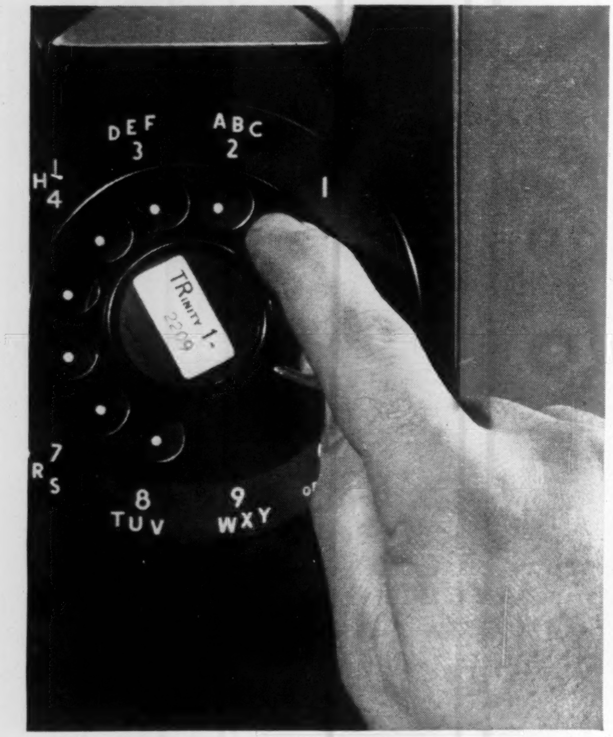


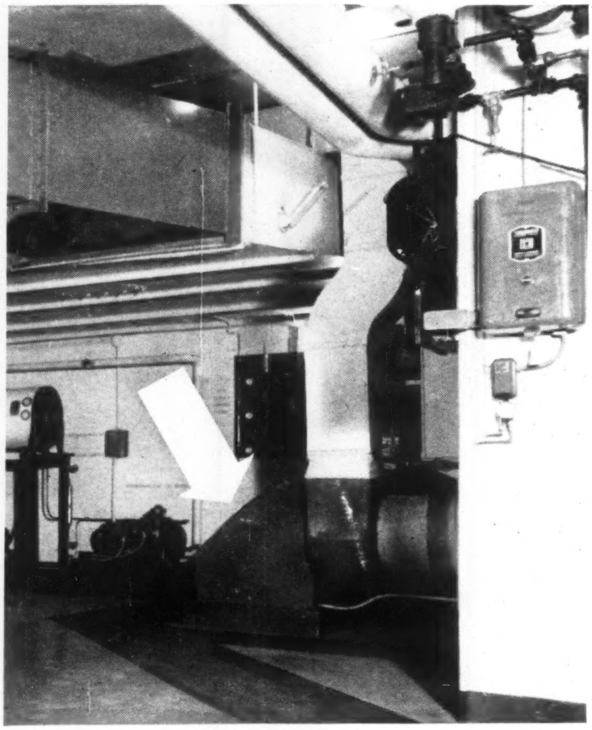
Webster's Finest Product . . . the Warren Webster Man

WARREN WEBSTER

HEATING . . . COOLING

FROM TELEPHONE BOOTHS . . . TO INDUSTRIAL PLANTS



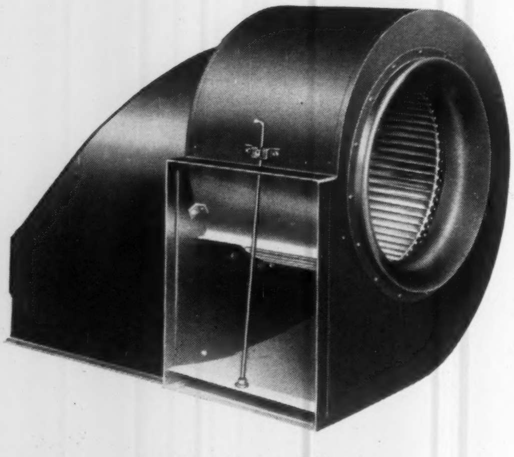


. . . here's the most versatile package unit that ever solved a ventilating problem!

We call them utility sets because they handle such a wide variety of ventilating problems.

Self-contained, American Blower Utility Sets, in a wide range of sizes and capacities, are used to supply or exhaust air in a wide variety of applications requiring a duct system. That means from small-capacity driers, laboratory exhaust systems, to the supply and exhaust requirements in hard-to-reach areas of public buildings, apartments, schools, hospitals, or industrial plants.

As individual package units, they are easy to install, economical to operate. And they're engineered by American Blower—specialists in the design and manufacture of air-handling and air-conditioning equipment for over 75 years. So why not call your electrical contractor or supplier today for full information; or write: American Blower Division of American-Standard, Detroit 32, Mich. In Canada: Canadian Sirocco products, Windsor, Ontario.



American Blower Utility Set

AMERICAN BLOWER

Division of **American-Standard**

American-Standard Products

"Open for Discussion"

• *WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

Basically Favors "Base Bid" Principle, But Sees Pitfalls

We have read the article *Do "Base Bid" Specifications Reduce Costs, Improve Quality?* by K. M. Wilson in the May 1956 HPAC and the comments on it by an unknown writer in the November issue.

We should like to comment further on this subject since we are just beginning to incorporate the "base bid" idea in our own specifications. We are basically in favor of Mr. Wilson's remarks on the base bid principle, but we also see the pitfalls that the writer brings out in the November HPAC.

Our experience with the base bid specification with alternates submitted for approval during the bidding period is that very few alternates appear if any. The reason for this is that the subcontractor who lists alternates with his bid is apt to lose out on the job because the general contractor will use the subcontractor who has no alternates listed if the prices are reasonably close. This means the subcontractor might jeopardize his chances of winning by listing alternates.

To strengthen the base bid theory we have incorporated a refinement to this degree. We specify one product by name for each item to do a certain job throughout the project. This constitutes the base bid. If no other product can do the same job either in performance or appearance, etc., no alternate is requested.

If, however, there are comparable products available that can do as good a job as the one selected for the base bid, they are listed as alternates to the base bid. The alternates must be selected as carefully as the original base bid item. The subcontractor must list these alternates with their prices — either more or less than the base bid — together with his base bid. Failure to list these alternates nullifies the subcontractor's bid.

We feel this is a big step by having the alternates bid on by all concerned because it reassures the subcontractor that all tenders will be dealt with on an equal basis. Also the manufacturer of the alternate material is sure to be included, as has not been the case up to now even though much time has been spent quoting in the past but to no avail.

From our viewpoint as consulting engineers we can see many advantages. First, we are reassured that our client will get the material specified. Secondly, the bid is competitive to the extent of the alternates. Further the "shopping" is eliminated, and the successful contractor is assured of a fair price for his job, with the costly and argumentive method of submitting approvals done away with.

Someone will say this is selective bidding. Of course it is and it should be. The consulting engineer spends most of his time selecting the proper piece of equipment to do a certain job. We realize many products can fulfill a specification but there is not a man alive who can keep abreast of every product on the market. We feel the consulting engineer has a big job in keeping well informed on the items he is specifying. If a manufacturer is not specified, the reason is that the product is not familiar to this engineer or that it will not be suitable for the job.

The manufacturer must sell his product to the engineer. A catalog in the mail is not enough. Our office policy is to take a half day each week and all our designers go into the field to see the equipment specified in operation. This is the chance a manufacturer needs to show us what his equipment will do. Words are not enough.

We think our base bid method with compulsory alternate bidding is the right step towards clean cut business.

W. M. Flanagan
Flanagan & Black
Consulting Engineers
Toronto

Finds Article on "Base Bid" Specs Stimulating; "Should Be Widely Read"

It was most encouraging to see the discussion in the November 1956 HPAC on Kenneth M. Wilson's article *Do "Base Bid" Specifications Reduce Costs, Improve Quality?* published in the May 1956 HPAC.

While I cannot agree with most of the thoughts expressed by the anonymous writer whose comments were in the November issue, I hope it will encourage others to read Mr. Wilson's stimulating article. I believe almost everyone in the industry can greatly profit by reading it.

Although the writer criticizes many of the ideas expressed by Mr. Wilson, in the end he seems to give them complete endorsement. I feel quite certain that Mr. Wilson did not mean to advocate the use of the base bid type of specification for standardized items of material and equipment on which the dimensions, appearance, and performance of several manufacturers are the same. I assume it is primarily to be used for nonstandardized equipment and special apparatus, where dimensions, services, and performance of equipment differ from one manufacturer to another.

In the spirit of "Open for Discussion," there are a few items which I would like to comment on. The anonymous author asks "How long is Mr. Wilson going to keep on specifying a John Doe unit? Other makers may bring out a better one, but the salesman offering that unit may have given up calling on Mr. Wilson because he feels it is a waste of time." It would seem to me rather that the salesman offering a better unit would tend to feel he is wasting his time with the consulting engineer who persists in writing an "or equal" type of specification.

The writer also seems to have missed the point on the matter of drawings. One of the reasons the drawings of so many engineers are not helpful for installation purposes is that they are deliberately trying to write a specification and a plan that can accommodate anyone's and everyone's equipment. I too have never seen Mr. Wilson's drawings, but I feel confident that when they are based upon definite equipment and apparatus, they can be detailed to a point where they can result in reductions in costs for the contractor figuring the work.

Albert Giannini
District Sales Manager
Machinery and Systems Div.
Carrier Corp.
New York

Expansion Tank Should Be Connected At the Suction Side of the Pump

I have read the article *Where Should Expansion Tank Be Connected?"* by Harry Terry in the January HPAC and would like to comment as follows:

It has been considered that the preferable location for the expansion tank connection, in forced circulation hot water systems, is near the circulating pump suction. This location would still be desirable even if the system is zoned. If the system is zoned, it could be quite important for the connection to be so located.

Systems have been spoken of as being "zoned" when they were not piped in the manner currently understood or implied by the term "zoned." For example, some larger systems have been spoken of as being "zoned" when the piping has been valved off to form a number of separate circuits, so that one could be shut off and the others left in operation, although the circulation through them was provided by the same pump or group of pumps. In such an instance the pumps were installed so that they operated in parallel and maintained the circulation in all of the circuits in common. Two or more pumps were installed for the purpose of providing "standby" service. In an installation of this kind each pump must be capable of operating against the head required for the zone with the greatest friction. However, this is not the case if each piping circuit is "zoned" so circulation within it is maintained by an individual pump as the term is understood to indicate by current usage.

As currently understood, a zoned forced circulation hot water heating system is considered to be one in which the flow within the circuit of each zone is provided by its own pump. There are as many pumps in the system as there are zones. The pumps do not operate in parallel to maintain the flow in all zones in common but each operates against the friction head of its own particular circuit. In such a system each pump must provide the head for the friction of that circuit and not for the friction of the zone having the greatest frictional resistance. Desirably the point of lowest pressure for each zone would be at its end, near the inlet to the pump, and the point of highest pressure at the zone inlet; which would be near the pump discharge. This relation of pressures is obtained by connecting the expansion tank at the suction side of the pump.

D. N. Crosthwait
Technical Adviser
Dunham-Bush, Inc.
Michigan City, Ind.

Hits Claim of "World's First Fully Air Conditioned Clothing Factory"

An article appearing in the November 1956 HPAC titled *Package Units Provide Worker Comfort* describes a package unit air conditioning system for the "world's first fully air conditioned men's clothing factory." I feel that I must take exception to this statement.

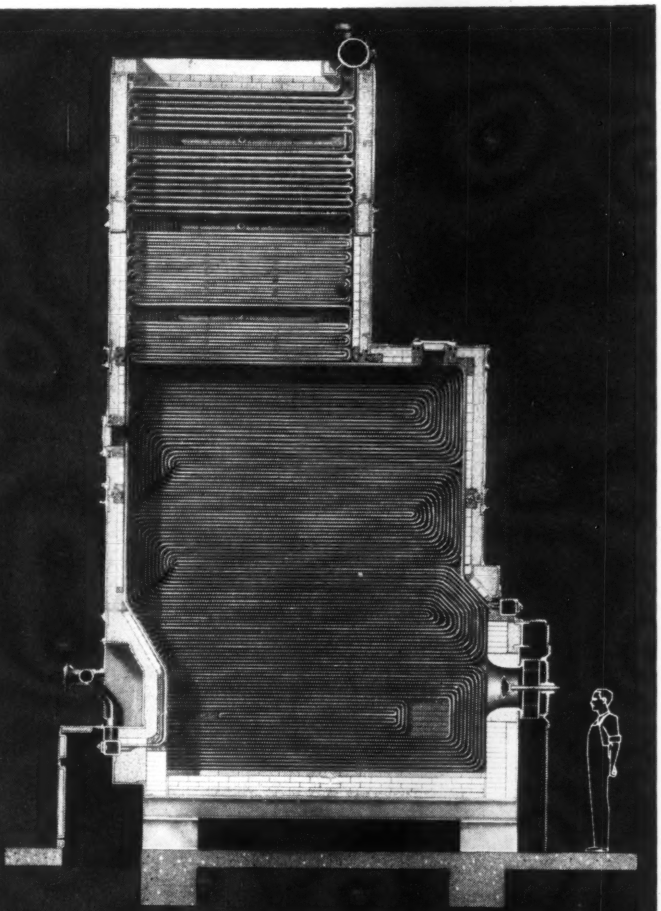
As early as 1953, the management of Haggar, Inc., manufacturer of men's slacks and suits, recognized the need for comfort conditioning for their workers. Since that time, the consulting engineering firm of Blum and Guerrero has designed and supervised the installation of approximately 500 tons of air conditioning systems for the Haggar chain of factories. The plants are in Dallas, McKinney, Corsicana, and Greenville, Texas.

The systems are all of the built-up type, utilizing reciprocating compressors, direct expansion coils, and filtered air circulation systems which, by automatic temperature control, take maximum advantage of outside air.

These systems have all been in operation through the past two cooling seasons.

James M. Purdy
Blum and Guerrero
Consulting Engineers
Austin, Texas

How about HIGH TEMPERATURE WATER *for your heating or processing needs?*



C-E La Mont Controlled Circulation Hot Water Boiler

ADVANTAGES

1. Complete control over HT water movement in both system and boiler.
2. No separate boiler pump is required since low pressure loss is inherent.
3. Pressurized operation with oil or gas means no induced draft fan.
4. Single-pass design—no baffles—means cleaner boiler and lower draft loss.
5. More efficient heating surface can be arranged because of controlled, positive circulation.
6. Any fuel—oil, gas, coal, or any combination of fuels.
7. Other features such as: gastight, welded steel casing . . . fewer headers, all of which are accessible.

If you are planning a new installation for space or process heating, you may be overlooking a good bet if you don't consider high temperature (HT) water as well as steam. Both have their advantages—and Combustion can serve you either way—but there are many cases where HT water is decidedly advantageous from both economic and operating standpoints. A comparatively new development in this country, high temperature water (temperatures up to 470 deg. F with pressures to 500 psi—higher if required) is applicable to the heating and processing needs of industrial plants, large buildings and institutions, and military bases.

Here are some of the advantages inherent in high temperature water systems:

1. The higher available heat in HT water—many times that of steam at the same pressure.
2. Closer control of temperature.
3. Heat loss is lower with the HT water closed system . . . unused heat returns to the boiler . . . no condensate return lines.
4. No elaborate feedwater treatment required. Make-up requirements are exceptionally low.
5. Steam traps not required—trap problems and attendant expense are eliminated.
6. No blowdown losses . . . no safety valve vent losses . . . no condensate losses.

If HT water is best for your requirements, you can realize its advantages fully with a C-E La Mont *Controlled Circulation* Hot Water Boiler. The basic design of this boiler is not only ideally suited to the generation and distribution of heat in an HT water system, but provides the specific advantages listed in the box opposite. Moreover, it is backed by wide application experience both in this country and abroad.

If you're interested in the possibilities of HT water, we'd like to send you our new catalog, No. HCC-2.

B-837B

COMBUSTION ENGINEERING

C·E

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

Question
of the
Month

What's the Correct Way to Trap Steam Headers and Tracing Lines?

This question was asked previously in HPAC and is repeated here along with some of the answers that have been received from readers. Other answers or comments for publication are invited.

> *"We have been having considerable discussion as to the correct method of trapping steam headers and steam tracing lines, and we would like to know if others have some suggestions.*
>
> *"We are confronted with determining the correct distance between traps on a steam header and on steam tracing lines. Steam pressures will vary from 2 psi to 400 psi. The tracing line sizes are from ½ in. to 2 in. in diameter. These installations will be in various parts of the country from Louisiana to Canada"—E.R.E.*

Avoid Making the Trap Too Large, As Condensing Load Is Usually Small

STEAM HEADERS should be trapped at both ends, if of some length, but if short, may be trapped by one trap. The header should be pitched toward the trap. Any rise in the header must be trapped. As headers are usually well insulated, the size of trap will be small because the actual condensing load will be small.

Should priming occur, no trap will be adequate and this contingency, therefore, need not be taken into consideration.

Usually a ¾ in. trap is ample. In the writer's observation many engineers have erred in making the trap size too large. For low pressures — up to 10 psig — a trap of the float thermostatic type is best. For pressures above 10 psig several types such as bucket, float, thermostatic, and thermodynamic traps may be used, but thermostatic traps are not recommended for header drip. To drip tracer lines the trap should be spaced not more than 100 ft apart, and any rise in the line must also be trapped.

The tracer line must be pitched in the same direction as the line being heated — they are wrapped together with insulation — and the pitch should be in the direction of flow.

To calculate the size of trap, the actual length of run, the size of the tracer pipe is expressed in equivalent sq ft of pipe surface considered as bare pipe. The size of the line being served, the loss of heat in the tracer line must all be considered. The insulation factor can be neglected as this will not apply at the time heat is turned on in the tracer line. Some allowance for excess capacity is desirable — say a safety factor of two. But with this the trap sizes for tracing line sizes of ½ in. to 2 in. will be small and a ½ in. or ¾ in. trap is usually sufficient for the maximum calculated load.

Thermostatic traps, which allow the condensate to pass out at a lower temperature than the temperature of condensate at the given steam pressure will be found to be efficient and therefore desirable. Other types such as bucket, thermodynamic, and float thermostatic traps may also be used.

Incidentally, the heat loss factor for the traced line should be considered as 3 Btu per hr per sq ft per F temperature difference between the temperature of the traced line and that of the surrounding air.

ROBERT W. CUMMING
Registered Professional Engineer
Scarsdale, N. Y.

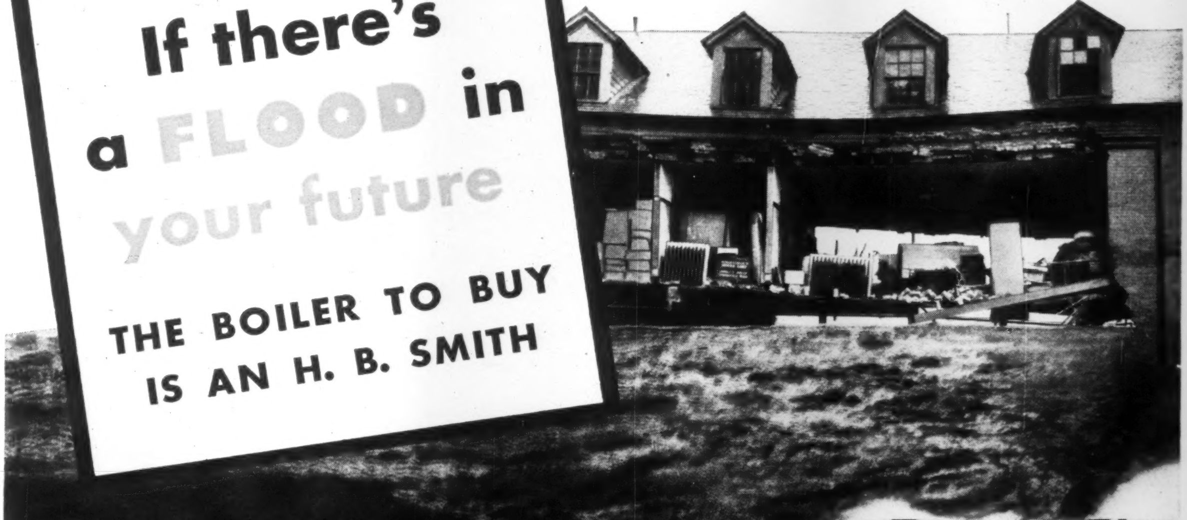
Space Not Over 500 Ft Apart; Allow for High Condensation During Warmup

LOCATION or spacing of traps for steam service is dictated by the geometry or configuration of the piping. The lines should be pitched to the trap to keep the pipe full of condensate and prevent possible vapor binding. This is of particular importance if the line is oversized. The trap should be in the lowest part of the circuit to permit drainage. Pockets should be avoided but if necessary, they too should be provided with traps. It is recommended that the maximum distance between traps not exceed 500 ft, and that traps

(Continued on page 92)

If there's a FLOOD in your future

THE BOILER TO BUY IS AN H. B. SMITH

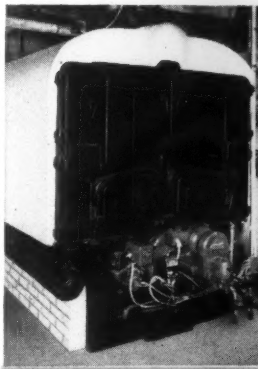


One of the buildings of the Sterling Radiator Company, Westfield, Mass., as it appeared during the flash flood of August 19, 1955.

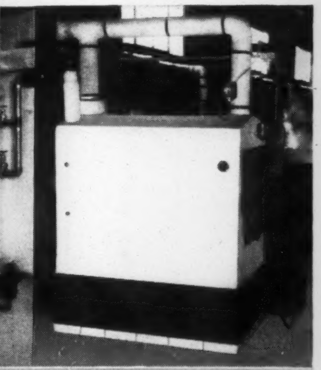
This is how one of the boilers looked after the flood water subsided.

The northeastern flash floods of August, 1955, left little worth salvaging in their wake. At the Sterling Radiator Company, Westfield, Mass., for example, one wing of the steel manufacturing building containing the boilers was torn open, and the welding and paint shops were completely destroyed. *The only reclaimable equipment was the two H. B. Smith cast iron boilers.* Even though forced from their foundations and up-ended by the flood, damage was so slight that they were quickly and easily repaired, and are now back in operation.

Obviously, there are many attributes other than their amphibious qualities to recommend H. B. Smith cast iron boilers. Consider their prodigiously long life, rapid steaming and high capacity, low maintenance, ease of convertibility from the use of one fuel to another, ready expansibility and economy of operation. These are a few of the reasons why an H. B. Smith cast iron boiler should be first choice for your building, whether or not a flood is to be listed among your operational hazards during the next 50 to 60 years.



The H. B. Smith No. 44 Mills boiler as it appears on its new foundation.

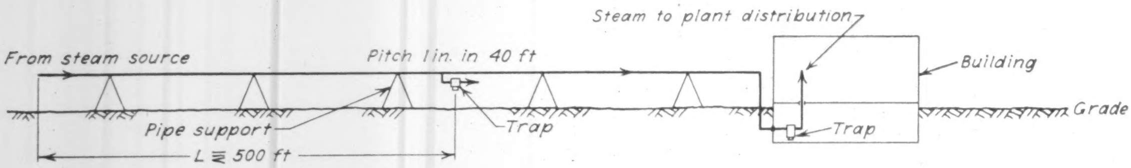


The Smith-Mills No. 200 boiler was restored within a week after the flood and has been in constant use.

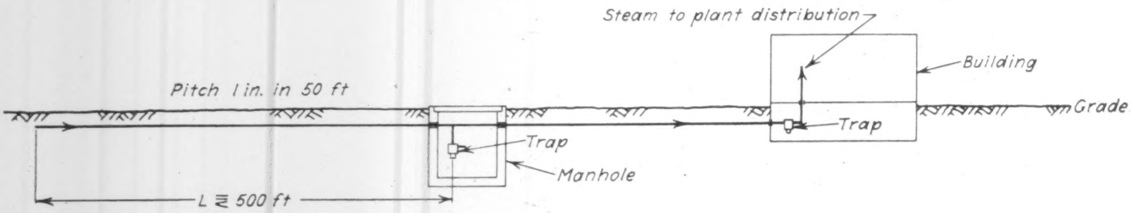
H.B. Smith CAST IRON BOILERS

H. B. SMITH CO., INC., WESTFIELD, MASSACHUSETTS • *Established 1853*

(Continued from page 90)



1 ABOVE GRADE outdoor steam main is typically arranged as shown here



2 BELOW GRADE buried steam line may have less pitch than common above grade to reduce excavation

be located in an accessible area for ease of inspection and maintenance.

The pitch or slope varies, frequently being influenced by structural and topographical conditions. For indoor applications, a pitch of 1 in. in 30 ft is frequently used. Where steam pipes are located outdoors, the slope is affected by height of pipe supports above the ground, which is usually fixed by maintaining required head room for movement of vehicles or personnel. A pitch of 1 in. in 40 ft is common for this service.

A typical arrangement of an outdoor steam main above grade is shown in Fig. 1. To keep excavation and backfill costs at a minimum, pipes buried below grade may employ less slope. A pitch of 1 in. in 50 ft may be employed. Representative details for this type of installation are shown in Fig. 2. Where traps are below grade, a manhole should be provided for accessibility.

When sizing traps, consideration should be given for the high condensation rate occurring during warmup of a cold system. Trap manufacturers apply a factor to the normal rate which allows for these conditions. For steam mains and tracers, 200 percent of normal condensing rate is suggested as a minimum value. Other percentages are applied for equipment such as heat exchangers, vats, and tanks, the value depending upon the type and mass of construction materials.

The following formula may be used to estimate the rate of condensation during warmup periods:

$$Q = [W\,(t_f - t_i)\,0.114]\ (60/h)/T \quad \ldots\ldots\ldots\ldots\ldots [1]$$

where: Q = Condensation rate, lb per hr; W = Total weight of pipe, fittings, etc., lb; t_f = Final pipe temperature (steam), F; t_i = Initial pipe temperature (air), F; 0.114 = Specific heat of wrought iron and steel pipe, Btu per lb per F; 60 = Minutes per hr; h = Latent heat of steam at t_f, Btu per lb; and T = Warmup period, minutes.

From the above, it may be seen that long warmup periods give reduced condensing rates, thereby permitting use of smaller traps.

H. B. Wayne
Consulting Engineer
Woodhaven, N. Y.

READER ASKS—

"How Can Makeup Air Be Heated?"

"An industrial plant has two exhaust systems, of 12,000 cfm and 30,000 cfm capacity, respectively. As these systems serve two separate areas, makeup air must be introduced into each area.

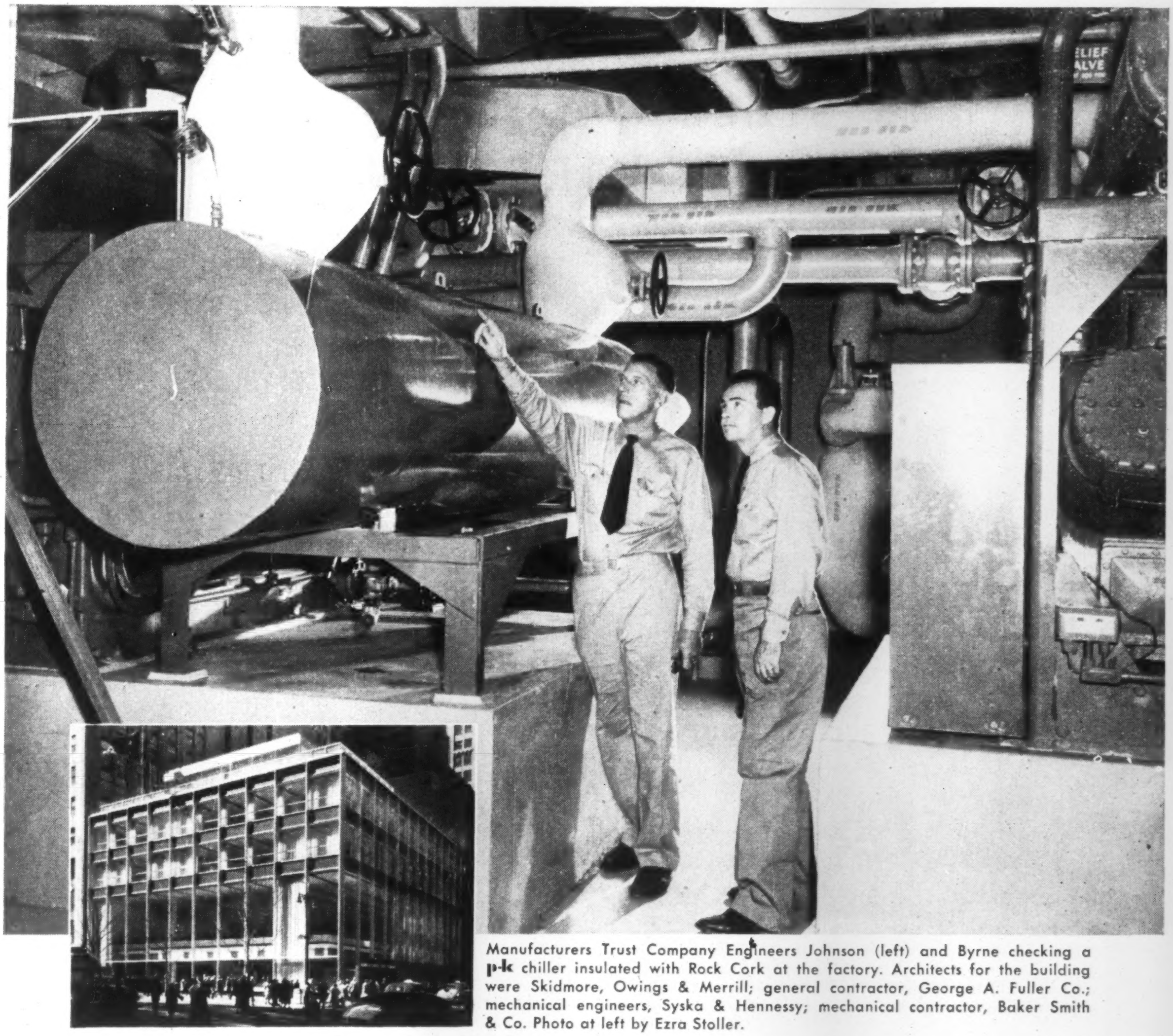
"This makeup air is to be heated to a minimum temperature of 65 F from the outdoor design temperature of −10 F.

"The 12,000 cfm of makeup air is to be heated from the 600 F waste gases from a gas heat treating oven in that area.

"The 30,000 cfm of makeup air is to be heated from the 300 F waste gases from a gas heat treating oven in that area.

"We are anxious to select the proper heat transfer equipment to heat this makeup air. We would like to use hot water as an indirect means, but we will appreciate any suggestions from other readers."—E.J.M.

- *YOU ARE INVITED to contribute a question for publication or an answer to a published question. Write: The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*



Manufacturers Trust Company Engineers Johnson (left) and Byrne checking a p-k chiller insulated with Rock Cork at the factory. Architects for the building were Skidmore, Owings & Merrill; general contractor, George A. Fuller Co.; mechanical engineers, Syska & Hennessy; mechanical contractor, Baker Smith & Co. Photo at left by Ezra Stoller.

Worthington relies on p-k chillers in the world's most distinctive bank building

When this "house of glass" opened at the corner of Fifth Ave. and 43rd Street in New York last year, 40,000 visitors came to take a look. Small wonder! For in this newest and largest branch of Manufacturers Trust Company, they saw architectural history being made.

No longer are bank tellers "caged." Customers transact their business in a new atmosphere of space, light and friendliness.

Contributing to this feeling of unhurried friendliness are two 150-ton Worthington air conditioning units, each equipped with a p-k dry expansion Freon chiller. This super-efficient system "reconditions" all five stories of the building every three to five minutes with 97,000 cu. ft. of fresh, low-humidity, 74 F air. It's automatic, too, shutting down by itself at 11 P.M. and starting again at 6 A.M., to assure a comfortable working climate for the bank's 280 employees — and their customers — at the start of each day.

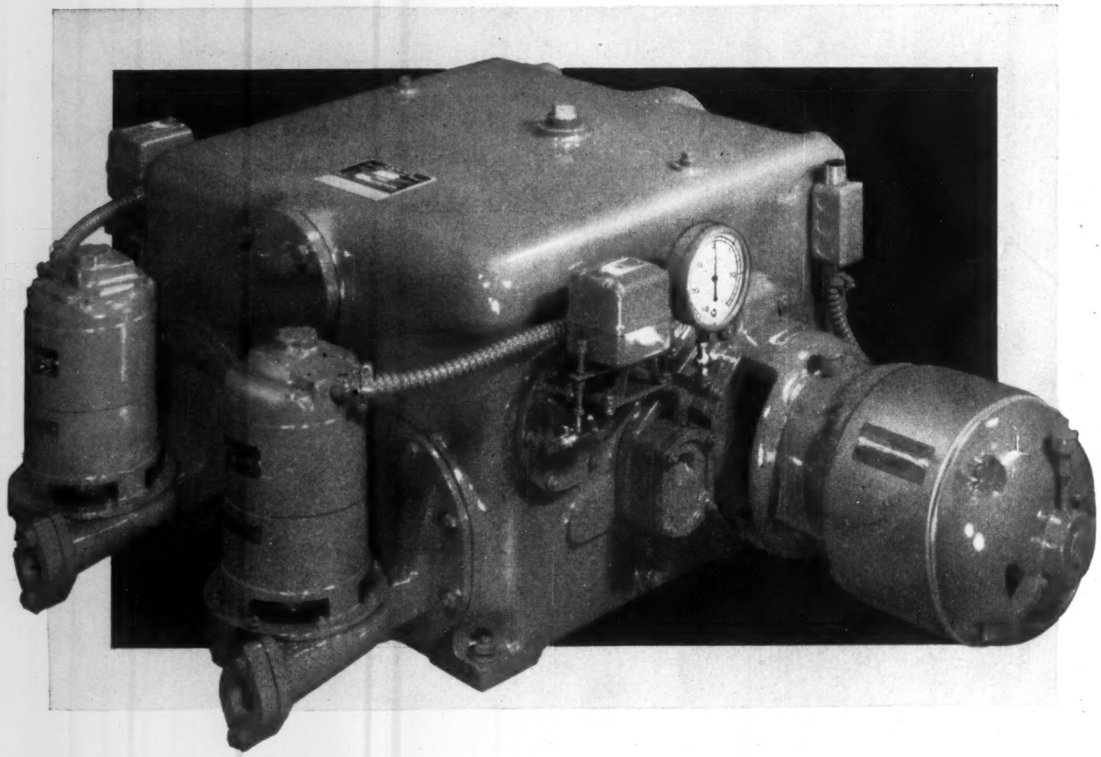
Teamed up with Worthington's famous "million dollar" compressors, p-k chillers each supply blowers with 331 gallons of water per minute, chilled from 50 F to 40 F.

For full information on these complete units write Worthington Corp., Dept. PK, Harrison, N. J. today. Or write for Catalog 101 on p-k chillers to The Patterson-Kelley Co., Inc., 730 Burson Street, East Stroudsburg, Pa., and principal cities.

PATTERSON-KELLEY

Flooded and Dry Expansion Type Freon Coolers and Storage Water Coolers • Freon Condensers • Allied Refrigeration and Air Conditioning Equipment

THIS NEW VACUUM HEATING PUMP IS SIZED TO ACTUAL JOB REQUIREMENTS



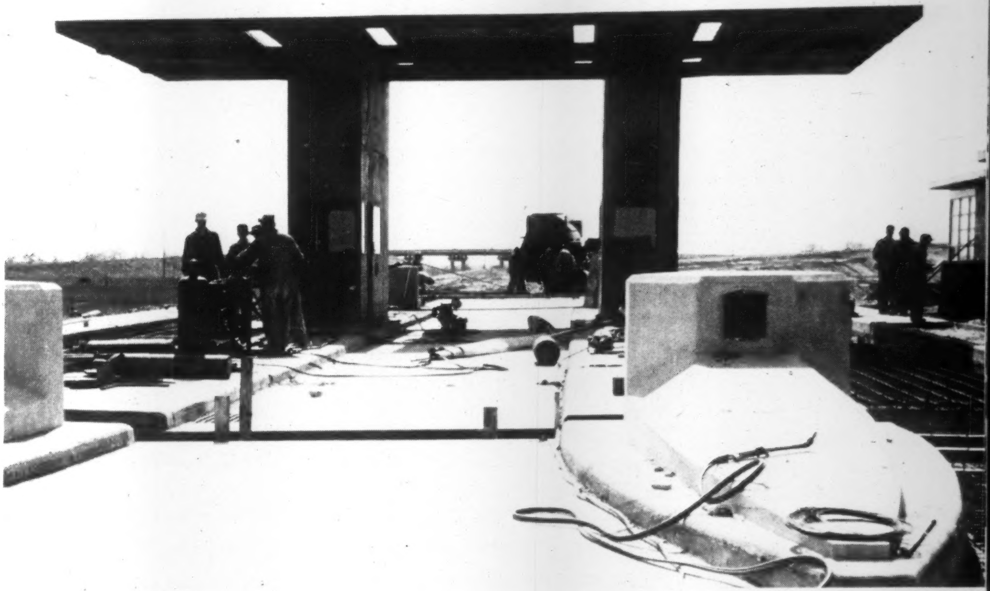
It's the Nash CSM

No longer is it necessary for the Engineer to accept a vacuum heating pump with air and water capacities based inflexibly upon square feet of equivalent direct radiation. With the flexible Nash CSM he can provide for proper air capacity in accordance with his judgment and experience. For the individual capacities of the separate pumps on the CSM may be varied within a wide range, without buying an oversize receiver and oversize water pumps.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- ✓ **Increased air capacity induces rapid system response without wasteful overheating.**
- ✓ **Separate air and water pumps individually selected to meet actual job requirements.**
- ✓ **Control system that operates individual pumps only when needed.**
- ✓ **Flexibility permitting addition of radiation without changing basic pump installation.**
- ✓ **Low, low, return line connection.**

NASH ENGINEERING COMPANY
438 WILSON, SO. NORWALK, CONN.



Grid type coils carrying heat transfer oil maintain surfaces at 36 F to . . .

Melt Snow at Toll Road Plazas

Twelve snow melting systems essentially identical except as to size and capacity serve all the toll plazas on the new Indiana toll road. Each system includes an oil fired twin boiler installation that generates 5 psig steam. In a shell and tube heat exchanger the steam gives up its heat to a stream of heat transfer oil circulating through the tubes. The warm oil is pumped by positive displacement pumps out through the piping systems embedded in the slabs. All major equipment is in a basement at one end of a tunnel under the plaza.

BY RILEY SHUTTLEWORTH
Consulting Engineer

EACH of the 12 toll collection plazas and terminals strung across the new Indiana east-west toll road from Chicago to Ohio is equipped with a built-in snow melting system. The first cost of these systems was more than $500,000, but they are expected to pay for themselves in a very few years.

The eastern and western terminals each consist of eight toll collection lanes 10 to 17 ft wide and 200 ft long. Scattered between these terminals lie 10 plazas where various state and federal highways make connection with the toll road. These inner plazas each have three to five toll lanes.

Between each pair of toll lanes lies a low, canoe shaped, concrete island upon which a toll booth is mounted. At the entering and leaving ends of each toll lane lies a short approach in which, like the toll lanes, snow melting pipe coils are installed. Crosswise of each plaza — terminals are included under this general term — is a tunnel 8 ft, 4 in. wide and 6 ft high which passes directly under

. . . thermostats in the roadway slabs automatically position modulating valves that control the flow of steam to the heat exchangers where the oil is heated. A motorized valve and manual switch for each lane permits manual shutdown of any individual lane.

the toll booths and the lanes separating them. One end of each tunnel ends at one edge of the plaza; the other end opens into the basement of a service building which stands at the opposite edge of each plaza. All of the major items of equipment in these snow melting systems, boilers, heat exchangers, and pumps are in these basements.

All of the 12 snow melting systems are essentially identical except as to size and capacity. Each system includes an oil fired twin boiler installation where 5 psig steam is generated. Steam is delivered to a shell and tube heat exchanger, where its heat is given up to a stream of heat transfer oil circulating through the tubes of the heat exchanger. The warm oil is pumped by positive displacement pumps out through the piping systems embedded in the toll plaza slabs.

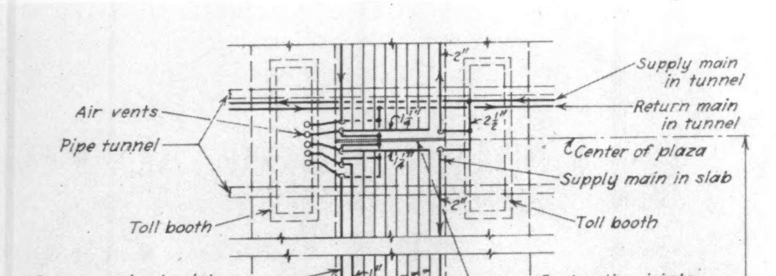
Control of these systems is automatic, simple, and direct. Thermostats in the roadway slabs near the surface position the modulating valves which control the flow of steam to the heat exchangers where the oil is heated. Thus the control systems perform only one limited function: they maintain the roadway surface at a constant temperature.

In addition, a manual control system consists of a motorized valve and manual operating switch for each toll lane by means of which any individual lane may be shut down.

How Much Heat Required?

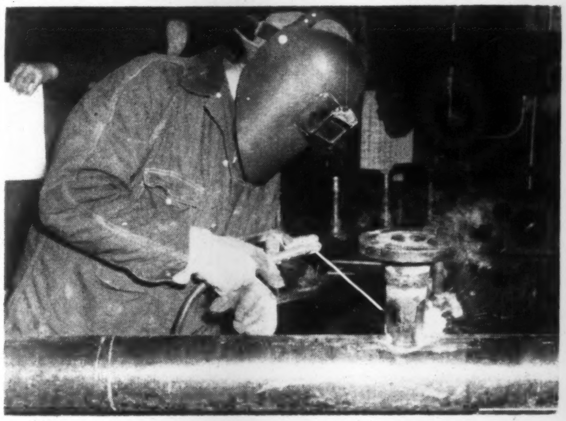
The first problem was to determine how much heat would be required. How to introduce this heat into the slabs in the right amounts and in the right areas was the next problem. In calculating the heat requirements of these systems, the figure of 125 Btu per hr per sq ft of roadway surface was used. This figure is in keeping with those used in similar installations in the Chicago and northern Indiana areas. It was felt that this figure was rather conservative in consideration of the fact that the decision had been made to maintain the slabs at operating temperature at all times, thus eliminating the need for quick pickup capacity.

The nominal heating, or snow melting, capacity of each system was calculated by multiplying the roadway surface area involved by the empirical constant 125. Thus in a three lane plaza where the roadway surface to be heated is approximately 8284 sq ft, including an increase for edge loss, the nominal capacity is 8284 × 125 = 1,037,000 Btu per hr.


Supply main in tunnel
Return main in tunnel
Air vents
Pipe tunnel
Center of plaza
Supply main in slab
Toll booth
Toll booth
2"
$1\frac{1}{4}$"
$2\frac{1}{2}$"
$1\frac{1}{4}$"
2"
Return mains in slab
Grid pipes, $\frac{3}{4}$"
Expansion joint, bellows type
Contraction joints in slab
Expansion joint, bellows type
1"
$1\frac{1}{4}$"
1"
$1\frac{1}{2}$"
1"
Scale pit, axle weighing
$1\frac{1}{4}$"
$1\frac{1}{4}$"
Concrete island
Concrete island
100'
Grid pipes, $\frac{3}{4}$"
Grid pipes, $\frac{3}{4}$"
Supply main in slab
$1\frac{1}{4}$"
End of plaza

GRID TYPE COILS of ¾ in. pipes spaced 12 in. apart are embedded 3 in. below the surface of the 10 in. slabs. Coil sizes are limited to areas between various transverse contraction joints, axle counting treadles, and scale pits

HOLES IN HEADER are being prepared here for insertion of ¾ in. steel pipes. Galvanized pipe sections are used at points where corrosion hazard is great



BRANCH CONNECTION for oil line is welded into header. All distribution piping embedded in concrete is welded. Line joints in grid are made with socket type couplings

The major items of equipment such as boilers, heat exchangers, pumps, and piping were then sized and selected with the use of this nominal capacity. Boilers were selected to have a Steel Boiler Institute net capacity of this amount plus 10 percent. Converters were selected to have this capacity plus 50 percent. Quantities of oil to be circulated were calculated with the use of this figure and the specific heat of the oil, which in this case was 0.43.

It was further decided that the snow melting coils should consist of comparatively small diameter pipes held fairly close together and as near to the roadway surface as practical. In these systems, ¾ in. pipes spaced 12 in. apart and 3 in. below the surface (to the top of the pipes) were used. Highway slabs are 10 in. thick in the toll plazas; and the pipe location, relative to the surface, was greatly influenced by the location of the reinforcing steel.

It was originally decided, also, that serpentine type coils would be used as much as possible. However, it was soon discovered that with serpentine coils, the pumping heads involved were tremendous. So the final design consists only of grid type coils modified to meet the odd shapes of the toll booth islands. Pipe friction, since a heat transfer oil is used, was calculated by computing the Reynolds number, selecting a corresponding friction factor from hydraulic curves, such as Cameron's, and then calculating the pipe friction thus:

$$h = (flv^2)/2gD \quad \ldots\ldots\ldots\ldots\ldots\ldots [1]$$

where h = pipe friction, ft of head; f = friction factor, from hydraulic curves; l = equivalent length of pipe, ft; v = oil velocity, fps; g = 32.2 (fps per sec, acceleration due to gravity); and D = inside pipe diameter, ft.

The Reynolds number may be calculated as follows:

$$R = (3162Q)/(dk) \quad \ldots\ldots\ldots\ldots [2]$$

where R = Reynolds number; Q = liquid flow, gpm; d = inside pipe diameter, in.; and k = kinematic viscosity of oil, centistokes.

The oil used in these systems has a viscosity, k, of 3.8 centistokes at 100 F.

Coil Design Complicated

The problem of designing the coils and working them into the overall pattern was greatly complicated by the fact that all toll lanes are cut across by several transverse contraction joints. Many of the lanes are also cut across by axle counting treadles and axle weighing scales.

The contraction joints are lines of weakness separating the slabs to control pavement cracking, if any, along predetermined lines. Since it is not safe to have snow melting pipes running through these lines of weakness, it was necessary to limit the coil sizes to the areas between the various contraction joints, treadles, and scale pits. However, supply and return mains did have to cross the contraction joints. This was achieved by placing a bellows type expansion joint, enclosed in a cast iron box, with one end directly on the contraction joint so that the main could elongate if and when cracking at the joint occurred. The top of the heavy cast iron box was set flush with the roadway surface and was removable for service to the expansion joint.

Because the roadway slabs are crowned for lateral drainage, and are also pitched to follow the desired roadway grade line, air binding can occur and manual vent cocks are installed — and enclosed in cast iron boxes — for the manual purging of air at these high points.

Each toll lane, having an area of approximately 2500 sq ft, is divided into either four or five sections. Each section has a separate snow melting coil. Thus an eight lane plaza has 35 snow melting coils.

Each lane is bisected at the midpoint, with two coils on one side and either two or three on the other side. The return lines from all coils in a given lane are connected to a return header in the tunnel, and each return is fitted with a balancing cock, a thermometer, and an automatic air vent — connected at the point where the return line drops to the tunnel.

The possibility of corrosion of the

ferrous piping at all points where supply and return mains run out of the highway slabs and into the fill below or where they pass through contraction joints or scale pits is guarded against by the use of sections of galvanized pipe long enough to extend at least 6 in. in both directions beyond the area of exposure.

All distribution piping bedded in concrete is joined by welding. All line joints in the grid piping are made with socket type couplings.

Pump In, Pump Out Oil

In the toll plaza systems, pump-in connections as well as pump-out connections are provided. At these connections hoses can be attached and extended to a nearby oil drum or tank truck. Since positive displacement gear type pumps are installed, no difficulty was experienced in filling the systems. Where low head, centrifugal pumps are used, an auxiliary gear type pump should be provided for pump-in and building static pressure.

Of course, an adequate pressure relief valve is provided on each system. These are piped directly to a very sizeable sump. It was felt that with the high volumes that are being pumped, as much as 700 gpm, a relief valve should not discharge into a floor drain; since it could not handle such a flow, and dangerous flooding of the boiler room could occur.

The manually operated — remote switch motorized valve controlling the branch supply mains serving each individual toll lane permits shutting down all lanes simultaneously in a given toll plaza. If the positive displacement pumps are running when this happens, excessive pressure could quickly build. To prevent this, a bypass relief valve is installed at each plaza. This valve is set to open at 50 psig and permit oil to flow from the supply main to the return main. The other relief valves mentioned above are set to relieve at 70 psig.

In these snow melting systems, closed type compression tanks, sized and selected in the normal manner, are used. Open expansion tanks do permit a certain amount of breathing of air in and out of the system; and, where oil is concerned, it is best to limit this air contact as much as possible. However, many open tank systems are in satisfactory use. But in the toll road systems, no suitable locations, from the standpoint of altitude, were available for open type tanks.

One requirement of these systems is the ability to reach operating temperatures quickly after they are shut down. It was felt that, if the highway coils in a given system were full of 10 F to 20 F oil, centrifugal pumps would not — unless greatly oversized — be able to overcome the greatly increased frictional resistance of the system and circulate enough oil to permit it to rapidly reach operating temperature. Therefore, positive displacement pumps are used. However, the driving motors had to be oversized almost 100 percent to give them the power to effectively circulate oil from a cold start.

Three pumps of equal size are at all of the intermediate plazas, and four are installed in each of the two terminals. In each case, one of the pumps is a standby pump, with the remaining two or three capable of circulating the full required amount.

Cite Characteristics of Oil

The circulating medium used in these systems is light weight oil having all the desirable characteristics required except two; and in these two respects this oil is, withal, reasonably good. However, compared to water, its heat transfer characteristics are at some disadvantage; and steam converters are appreciably larger than would be required if water were used. The other partial disadvantage is that of comparatively high viscosities at low temperatures. But, at a temperature of 100 F, the pumping head of a system using this oil is only 20 percent higher than that of the same system using water.

The oil for the Indiana toll road systems was delivered in 55 gal drums. The cost was approximately 90c per gal.

Oil filters, used in all systems, are capable of filtering the entire flow with a pressure drop of 2.0 psig when clean.

Ready to Melt Snow Anytime

The control systems automatically maintain the surface of the roadway at 36 F so as to be ready to melt snow at anytime, even if it comes quickly and without warning.

Each plaza has two, three or four thermostatic elements located in the roadway about $\frac{3}{8}$ in. down below the surface. Only one of these elements is used at any one time, but any one can be switched into use. The thermostatic control elements were inserted into short lengths — about 6 ft — of $\frac{3}{8}$ in. galvanized conduit which was set in the concrete $\frac{1}{4}$ in. below the surface, and which had one end sealed with the other end extended into a scale pit or out through the edge of an outer lane.

The thermostatic elements consist of a small $\frac{3}{8}$ in. diam plastic bobbin on which is wound some of the wire of an electronic control circuit. Changing temperature varies the resistance of the wire on the bobbin and upsets the balance of a Wheatstone bridge circuit; and a compensating action in the remainder of the circuit actuates the control mechanism. The modulating steam valve motor is operated directly by these thermostatic elements acting through an electronic control panel. The method of installation permits easy removal of the control bobbin for repair or replacement.

Cost Was $4.23 Per Sq Ft

Based on contract bid prices, the average cost of the complete mechanical installation, not including the necessary electrical wiring, was $4.23 per sq ft of snow melting area.

Operating costs have been very difficult to estimate, and reports of actual operating experience of other systems are not in agreement. But calculations based on an assumed standby loss of 40 Btu per hr per sq ft of snow melting area, fuel oil at 10c per gal, a five month snow melting season, and a 15 percent operating time indicate that fuel costs will be 2.16c per sq ft per winter. #

NYLON PLANT — the first wholly integrated one in the U. S. — will have a production capacity of 88 million lb per year this year. Plant office building and textile spinning area are in center foreground, and chemical intermediates area is at upper right

How to Install Piping for High Temperature Heat Transfer

BY C. E. COLE
Chemstrand Corp.

Proven practices for the installation of high temperature heat transfer piping for Dowtherm — a mixture of diphenyl and diphenyloxide — are described in this article. Although similar to steam piping, piping for this medium requires special provisions for cleanliness and leak prevention.

PIPING for Dowtherm — a mixture of diphenyl and diphenyloxide — is in general similar to steam piping. However, an understanding of the physical properties of it, especially the exceptional metal wetting quality, is important in the development of adequate specifications covering materials, workmanship, and testing.

This exceptional wetting ability, which enables the medium to penetrate the most minute pin holes and cracks, makes it exceedingly difficult to contain in the system. This quality also accounts for its ability to remove loose scale, rust, and dirt causing considerable maintenance problems.

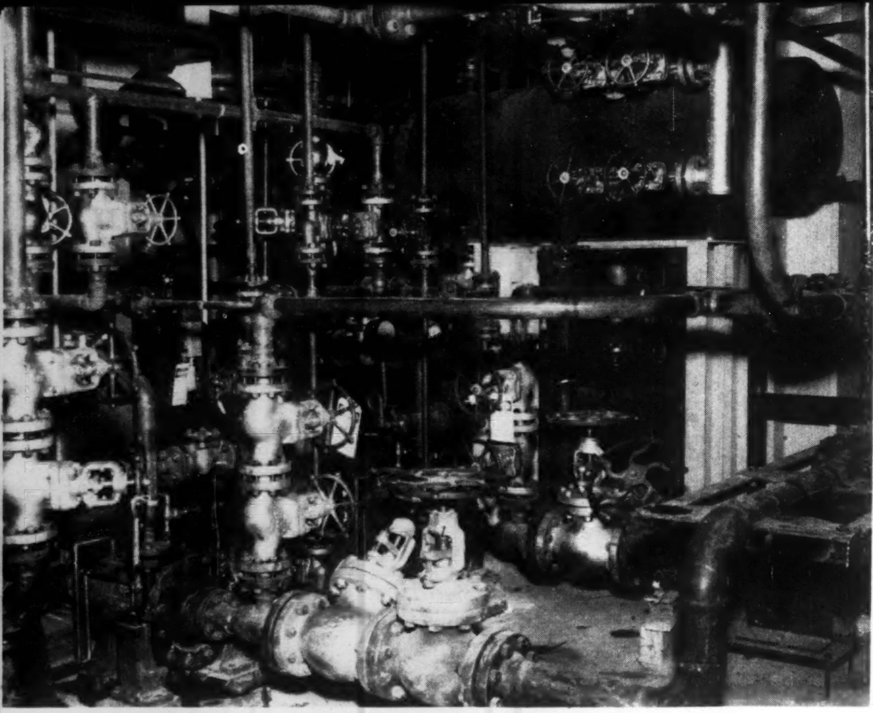
For these reasons, special provisions to provide for cleanliness and the prevention of leaks in the system are necessary. Methods and specifications covered herein have been used in a number of installations which are giving satisfactory operation.

Reduce Valve Leaks

Valves for this service are specified as 300 psig cast steel with ring joint flanges. This valve has a deep stuffing box and heavy flanges, which are advantageous design features from the standpoint of minimizing leaks.

These valves are designed to back seat so that stem packing can be replaced while the valve is in service in the open position. This feature also allows almost complete elimination of valve leaks in operating systems when valves are fully open or closed, provided that the valves are arranged so that pressure is always under the seat when in the closed position. The flanges have octagonal type ring grooves which use a solid soft iron oval gasket. The valve packing is an aluminum die molded ring, which must be packed very carefully to prevent a bind in the stuffing box. A stellited valve seat and stainless steel disc are used to prevent galling, as this medium has no lubricating qualities.

Leaks through valves can be a source of trouble where valve seats are slightly worn or scarred. For this



BEFORE INSULATION piping system looks like this. After pipe, valves, and fittings are carefully cleaned, they are prefabricated into sections, which are erected by welding and tested for leaks

reason, double valves are used in some installations in order to guarantee positive shutoff. This, of course, is an expensive type of system and would only be feasible in installations where positive shutoff is essential.

This piping is installed with welded connections, except for a sufficient number of flanged connections to permit dismantling or blanking as required for maintenance purposes. Where flanged connections are used, they are ring joint type flanges of 300 psig rating, using alloy steel stud bolts. Screwed pipe connections are occasionally used for pipe sizes 1 in. and smaller, but exceptional care is taken in the threading of pipe for this service to prevent the possibility of leaks.

Schedule 40 seamless carbon pipe, American Society for Testing Materials A106 or A53, is used for this piping, except for screwed pipe, where Schedule 80 pipe is specified.

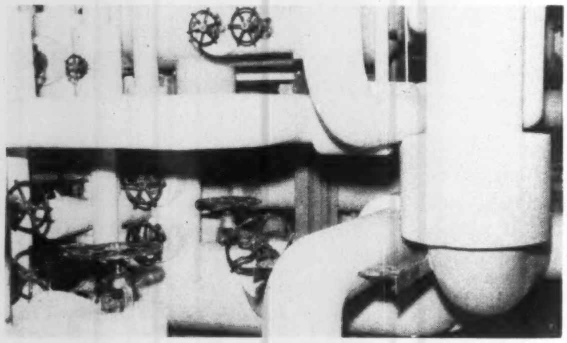
Pipe bends are preferred to elbows in 4 in. diam pipe and smaller. These bends are made on a compression type pipe bending machine. Where fittings are called for, 2000 psig forged steel socket welding fittings are specified for 2 in. diam pipe and smaller, and carbon steel butt welding fittings are specified for 3 in. diam pipe and larger.

Sandblast or Pickle

Due to the metal wetting qualities of Dowtherm, it will readily remove mill scale and rust from uncleaned pipe, causing improper control valve operation and damage to valve seats. To prevent such problems, all piping is thoroughly cleaned prior to installation by sandblasting or pickling.

Detailed pipe sketches are made of all piping so that it can be prefabricated in the shop into pipe sections. Each pipe section is hydrostatically tested prior to cleaning to test for structural soundness. Flanged pipe sections are prepared for testing by blanking off the ends with blind flanges. Plain end sections are tested by inserting expanding plugs in the ends.

Sandblasting of pipe is a very effective method of cleaning and is generally preferred for pipe that is large enough to insert the blasting nozzle so that the entire length of pipe can be traversed in order to make a direct sand blast against the pipe wall. It is not considered satisfactory to insert the nozzle in one end of the pipe and blow through the pipe and out the opposite end. All machined flanged surfaces and threads



AFTER INSULATION, system shows good piping practice. Double valves are used in some installations to guarantee positive shutoff where essential

SANDBLASTING is an effective method used to clean pipe. Blasting nozzle traverses entire length of pipe to make a direct blast against the wall. Another method is acid pickling must be protected during the sandblasting operation.

After sandblasting, the pipe is blown out with dry compressed air until clean. The cleaned pipe is sometimes protected further by spraying the interior surface with a liquid silicone solution. The ends of the pipe are then sealed with cardboard discs and taped to prevent contamination by dirt and foreign matter.

Where sandblasting cannot be used, the pipe is cleaned by acid pickling. Prior to pickling, oil and grease are removed from the pipe by spraying them with steam from a high pressure steam jenny, using a grease dissolving additive or by submerging them in a heated (180 F minimum) agitated solution of trisodium phosphate at a concentration of 1 lb per 10 gal of water.

As in the procedure for sandblasting, all machined flange surfaces and threads are sealed for protection before being placed in the pickling solution. The pipe sections are then placed in an acid resisting pickling tank made of concrete and lined with acid resisting brick. Water is added to the tank, plus an inhibited sulfuric acid, in the ratio of 10 parts water to 1 part acid, to make the pickling solution. The solution is heated to a temperature of 160 F to 180 F by adding low pressure steam through a lead pipe and held at this temperature until scale is removed. The sections are then removed from the tank, rinsed with water and neutralized with steam. The moisture is blown out with clean, dry air and the pipe protected and sealed as described above.

Valves for this service are disassembled and cleaned to remove metal shavings, grease, and dirt. The parts are cleaned in a heated solution of trisodium phosphate.

Weld, Erect Pipe Sections

Welding is a very important part of the piping from the standpoint of both cleanliness and leaks. The use of the heliarc welding process on the first connecting bead and the electric arc on subsequent beads, using inert gas back-up throughout the process, has given exceptionally good results in minimizing internal heat scaling and weld spatter. The heliarc bead is made with a 1/8 in. low carbon steel rod. The filler passes are made with 1/8 in. shielded arc carbon steel rods and finished out with 5/32 in. rods.

After the prefabricated pipe sections have been erected, the system is given an overall test for leaks. In installations where a source of the medium is available, the system can be heated slowly with a live solution, which provides a leak test under actual conditions. Leaks can be detected by a visible stream of vapor.

If a live test is not possible, the system can be tested for leaks by introducing ammonia gas to about 5 psig, and then adding air to within 50 percent of the normal operating pressure of the system. If leaks are present, they may be detected by a sulfur candle, a small stream of SO_2, or a hydrochloric acid swab. Any connected equipment containing copper is removed from the system during this test. The system is flushed thoroughly with dry air before replacing these copper containing elements since ammonia is very corrosive to copper.

The potential user of this medium should not become overly concerned about the exacting specifications necessary for a good piping system. Many of these are in the category of normal good piping practice. However, the value of a carefully engineered and installed system should not be underrated. The materials and methods used in the installation of this piping can be the difference between a good operating, low maintenance system and one causing constant trouble.

We wish to acknowledge the assistance of F. P. Shuler, mechanical superintendent of Daniel Construction Co., in the preparation of this article. ‡

Use Care when Welding to Prevent Fires

. . . in industrial plants

GAS AND ELECTRIC welding and cutting are two of industry's most useful and indispensable tools, but the careless use of this equipment continues to show an adverse fire record, according to the National Board of Fire Underwriters. In 1955, of the 225 building fires in the U.S. and Canada where the individual fire loss exceeded $250,000, welding and cutting operations were responsible for as many fires as any other single cause.

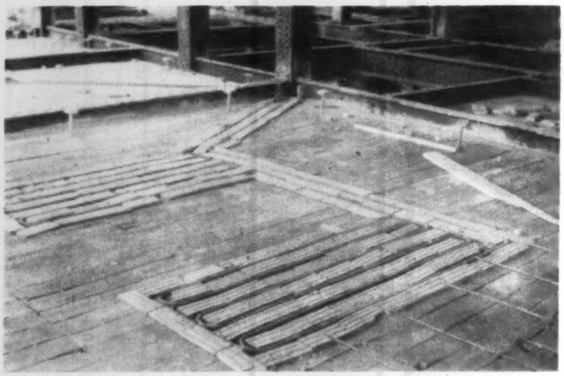
Cutting is the big offender because sparks and molten metal from cutting torches travel farther and are more likely to cause fires than sparks from gas or electric arc welding.

Portable equipment causes the greatest number of fires. Outside workmen frequently are not familiar with plant operations or the hazards that may exist, and as a result may not take the necessary precautions.

The NBFU recommends that welders or cutters obtain a permit from the person responsible for fire safety before they start their work.

When possible, cutting or welding work should be moved to a safe place.

The applicable standards for good gas welding and cutting practices are the NBFU *Standards for Gas Systems for Welding and Cutting* No. 51, and, for electric welding and cutting, the *American Standards for Safety in Electric and Gas Welding and Cutting Operations, ASA Z49.1*. A copy of the former may be obtained by writing to the Engineering Dept., National Board of Fire Underwriters, 85 John St., New York 38. For the latter, write to the American Standards Association, 70 East 45th St., New York 17. ‡



Resistance elements mounted in ceiling, wall, and floor panels . . .

Electrically Heat University Center

BY LESTER S. RIES
Consulting Engineer
Formerly Superintendent
Buildings and Grounds
Oberlin College

THE SENATE HOUSE of the University of London is in the Bloomsbury district just north of the British museum. The University is made up of about 51 colleges, institutes, and schools. Since 1900 the University has been both an examining and teaching body. It is governed by a Senate with headquarters in the Senate house.

The present development beside the Senate House is comprised of Birbeck college, The School of Oriental and African Studies, and the University Student Union. Incidentally, in 1927 the Rockefeller foundation appropriated $1,944,850 toward the cost of site purchase.

The heated volumes in cubic feet are:

Senate house (Portland stone group)	4,719,650
School for Oriental and African Studies	951,000
Birbeck college	1,276,000
University union (first stage)	563,350

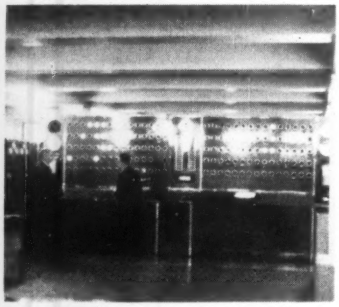
The Senate house was built in the early 1930's and was occupied partially in 1936. It is heated by means of electrical energy throughout, while the other buildings in the group are almost entirely heated by thermal storage of circulated hot water which is heated electrically. The heating of all the buildings is directed from a central control room in the Senate house basement under the supervision of the resident engineer, W. J. Jordan.

Senate House Heated Directly by Electricity

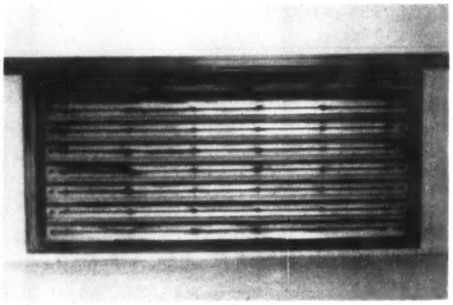
The main structure is eight stories in height, with several wings of four stories each. The building mass is surmounted by an impressive tower 209 ft high with an additional eight floors. The building houses mainly offices, conference rooms, a large hall, a small hall, a library, and numerous auxiliary areas such as library stacks and store rooms. A maintenance and housekeeping staff of more than 200 is employed for its operation.

The entire building is heated by the direct use of electrically heated resistance elements mounted in wall and floor panels.

SENATE HOUSE is heated by electrical energy throughout

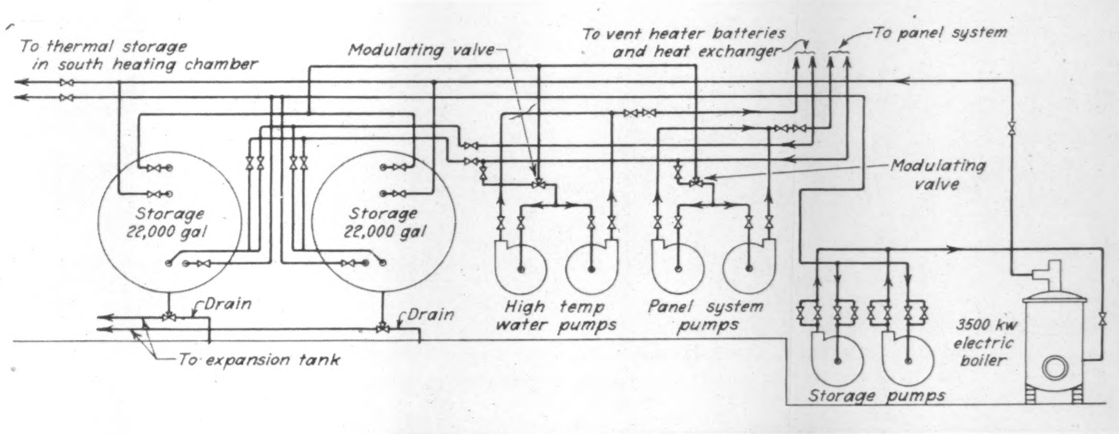


CONTROL BOARD has a vertical face and a horizontal surface also

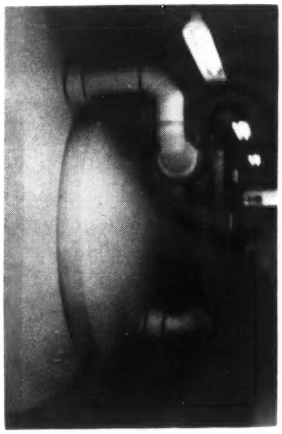


WALL HEATING PANEL, with cover removed, is mounted here as a dado

. . . hot water storage systems heat other buildings

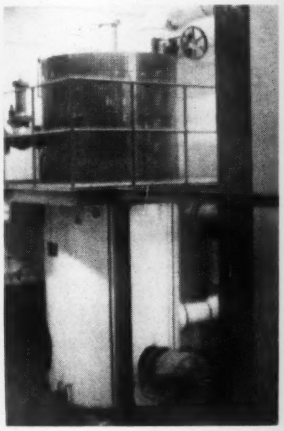

To thermal storage in south heating chamber
Modulating valve
To vent heater batteries and heat exchanger
To panel system
Modulating valve
Storage 22,000 gal
Storage 22,000 gal
Drain
Drain
To expansion tank
High temp water pumps
Panel system pumps
Storage pumps
3500 kw electric boiler

TWO HOT WATER HEATING SYSTEMS are similar and interconnected. System shown — not to scale — consists of electric boiler operating at 11,000 v and 3500 kw capacity, two 22,000 gal storage tanks, and circulating pumps. Space heating in three buildings is accomplished mainly by hot water circulating through ½ in. steel pipe ceiling panels



HOT WATER STORAGE TANKS have reserve capacity for future

CIRCULATING PUMPS serve three closed water circuits: storage tank-boiler; tank-heating panels; and tank-heat exchanger



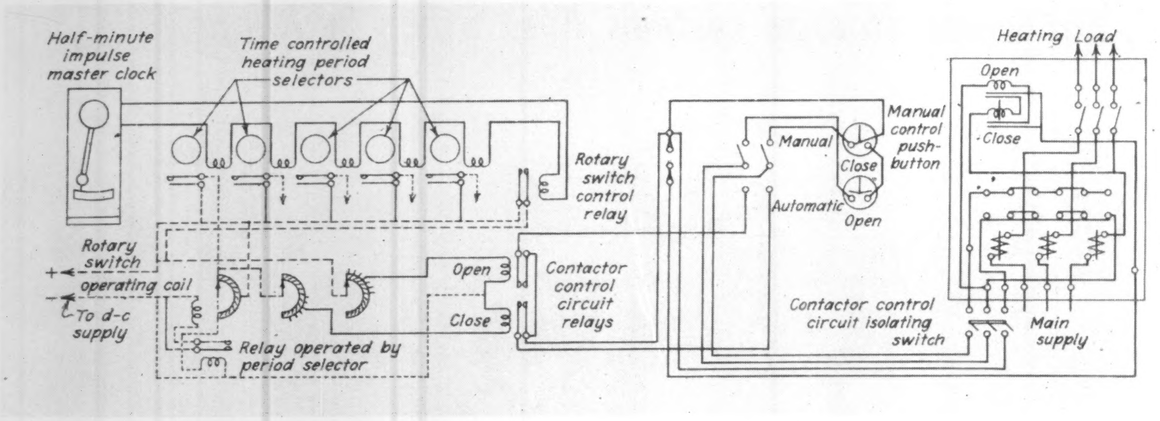
ELECTRODE BOILER — one of two shown — heats water in storage tanks in off-peak period

The National Electric Board — generation and distribution of electricity is nationalized — maintains a high tension vault in the basement of the building furnishing primary current at 11,000 v, three phase, through an 8000 kw capacity cable. Two 4000 kva transformers step the current down to 400/230 v. The switchboard is divided into two sections, one for space and water heating and the other for lighting and power.

The distribution centers for the heating circuits are five in number. There are upwards of 800 heating circuits branching from these centers, and the entire heating load is handled either automatically or manually by means of a control panel in the large switchboard room. Each distribution center has a capacity of 300 amp, 400 v, three phase.

Pushbuttons Control All Heating Circuits

The control board, as shown on page 102, has a vertical face and a counterheight horizontal surface. The vertical face is equipped with 150 telltale lights, 75 on each side of the center panel. The center panel is occupied by two banks of outlets that are connected to the more important rooms throughout the building, and the operating engineer can read the individual room temperature by plugging in a cord connection to the recording thermometer.


Half-minute impulse master clock
Time controlled heating period selectors
Rotary switch control relay
Rotary switch operating coil
+
−
To d-c supply
Relay operated by period selector
Open
Close
Contactor control circuit relays
Manual
Automatic
Close
Open
Manual control push-button
Heating Load
Open
Close
Contactor control circuit isolating switch
Main supply

TYPICAL CONTROL CIRCUIT shows automatic control wiring for the heating services. Upwards of 800 heating circuits branch from five distribution centers. The entire heating load is handled either automatically or manually by a control panel in the large switchboard room

The vertical face has in addition to the two recording thermometers a fire alarm indicator, a clock, a voltmeter, an indicating wattmeter, and a wind direction indicator.

The horizontal surface of the control board is equipped with pushbuttons for the remote control of all heating circuits. It also contains outlets for intercom and outside telephone service.

On the rear of the vertical panel there are mounted three impulse type master clocks, two of which control the general clock installations throughout the building and one for the time operated heating circuits control.

Typical heating panels, as shown on page 102 are specially designed. The heating element consists of No. 14 nichrome coil wire embedded in a magnesium oxide filler, all of which is encased in a 3/8 in. diam brass tube. These elements are mounted on anodized aluminum reflectors, one for each element, in horizontal banks, in series. These are set in a sheet metal box. Between the aluminum and the steel back of the box an insulation of sheet asbestos reduces the heat loss to the masonry. The elements are fastened at the focal point of the reflector by means of spring clips. The number of elements in each panel is determined by the exposure requirements. The cover of the steel box panel is made of a variety of nonflammable materials, generally typical of the wall surface in which it is mounted.

These heating panels are under the windows in the outside walls, as a dado in the interior walls in many of the larger offices and conference rooms, and as floor panels in rooms with French windows. In corridors the wall panel cover is marble, in rooms it is sheet steel or wood panelling, and terrazzo in the floors.

The units are installed so that the surface temperature of the wall panels is uniform at about 160 F while that of the floor panels is about 100 F. All heating elements are thermostatically controlled within the range of 63 F to 65 F in offices and occupied areas, 58 F to 60 F in corridors, 53 F to 55 F in toilets and store rooms. The resident engineer writes: "it is usual to allow a 5 F difference due solely to the heat created by occupational activities; that is, with an inside temperature of 65 F, heat is not required when the air temperature is 60 F." The outdoor design temperature is 32 F.

Tempered Air Heats, Ventilates Lecture Halls

The large and small lecture halls are heated and ventilated with tempered air by means of a fan driven by a variable speed 12 hp motor. Outdoor air is drawn through filters and preheated by means of an electrically heated grille of tubes of special design with a capacity of 120 kw. The air then passes through a series of water sprays; the temperature of the spray is maintained at a predetermined point by means of thermostatically controlled immersion heaters. The air then passes through eliminator plates and then through three sections of electrically heated grilles of 40 kw, each thermostatically controlled. The moisture content of the tempered air is controlled by means of an humidistat.

The heating grilles are interlocked with the fan operation and a recording thermometer and hygrometer provide a record of the condition of the air at the fan discharge. Each hall has its individual exhaust fan which is controlled at the basement control board.

Operate Heating Circuits Separately Or in Groups

The heating circuits branching from the distribution centers can be operated either individually or in groups by means of automatic time control equipment. The programs are set to accommodate the occupancy of the various offices and also to insure a cut-off of electricity at the peak periods in order that the off-peak current rate will be charged. In case of necessity the automatic control can be bypassed by manual operation during the peak period.

Duplicate installations of kilowatt-hour meters are provided to record: (1) the space and water heating high peak period rate; and (2) the space and water off-peak rate.

Two wells in the basement of the building are 610 ft deep and are equipped with pumps with a capacity of 800 gph to furnish water for the buildings. Domestic hot water service is furnished by thermostatically controlled electrical immersion heaters installed in individual 100 gal tanks under each bank of toilets. Each of the hot water circuits is operated by a time switch; 160 F water temperature is maintained for this service.

Thermal Storage Systems Heat New Buildings

Expansion of the University of London on the Bloomsbury site was begun during World War II and accelerated with the advent of peace. Birbeck college, the School for Oriental and African Studies, the University Student Union and the completion and occupancy of additional spaces in the Senate house constituted all the completed additions by the spring of 1956.

In the new buildings space heating is accomplished mainly by hot water circulation in ½ in. steel pipe ceiling panels. For serving this load two large thermal storage systems are installed, both of which are operated under the supervision of the resident engineer and his staff, who are located in the Senate house.

Two electric boilers — one operating at 11,000 v and 2500 kw capacity with two 17,500 gal storage tanks, and the other operating at 11,000 v and 3500 kw capacity with two 22,000 gal storage vessels — are installed for space heating.

The smaller boiler serves Birbeck college and the School for Oriental and African Studies, and the larger serves the Student Union — the first stage only of which is built — with reserve capacity for additional buildings.

The two installations are similar and interconnected but the larger being the more recent is of greater interest and is described below.

Pump Is Integral with Electric Boiler

The boiler is about 1000 ft from the control room in the Senate house in a basement space. It is about 25 ft in overall height, the boiler shell being 5 ft in diam and 19 ft high. Allowable gage pressure is 65 psig. The boiler operates on three phase, 50 cycle current.

Three stainless steel electrode bars 2½ in. in diam are each enclosed in a 7 in. OD quartz tube that operates as a shield for each electrode bar. The electrode bars are suspended from the top of the shell.

A pump driven by an 8 hp motor is integral with the boiler as shown on page 103 and is located almost at the bottom of the shell, the motor extending to the outside. The suction end of the pump is connected with incoming water from the storage tanks. The pump discharges into three pipes — one under each electrode — and the discharge pipes are so arranged that the discharge is vertically upward. This insures rapid movement of water continuously along each electrode and reduces the formation of steam bubbles on the heating surfaces.

Duplex pumps actuated by 24 hp motors serve to circulate the water from the bottom of the 22,000 gal storage vessels and discharge into the bottom of the boiler.

Two additional sets of duplex pumps driven by 5 hp motors are installed — one set connected with the thermal storage vessels and discharging through a mixing valve serving the space heating panels; the other connected similarly but discharging into heat exchangers for the domestic hot water supply.

Operate Three Closed Water Circuits

Thus, there are three closed water circuits in operation: (1) the storage tank-boiler circuit; (2) the storage tank-building heating panel circuit; and (3) the storage tank-heat exchanger circuit.

The heating system operates as follows: The boiler is started either manually or automatically. The position of the quartz tube surrounding each electrode determines the loading of the boiler. When lowered to its limits along the electrode just 20 percent of its capacity is available. From that minimum position it can be raised to expose up to the full length of the electrode and make the 3500 kw capacity available.

The starting switches are interlocked with the quartz tube positioner so that the boiler cannot be started until the tubes are lowered to the minimum load position. The quartz tubes are raised and lowered by means of a piston on the top of the boiler whose stem extends through the boiler shell. The positioning of the piston is accomplished by means of a pump discharging oil under pressure on the required piston surface.

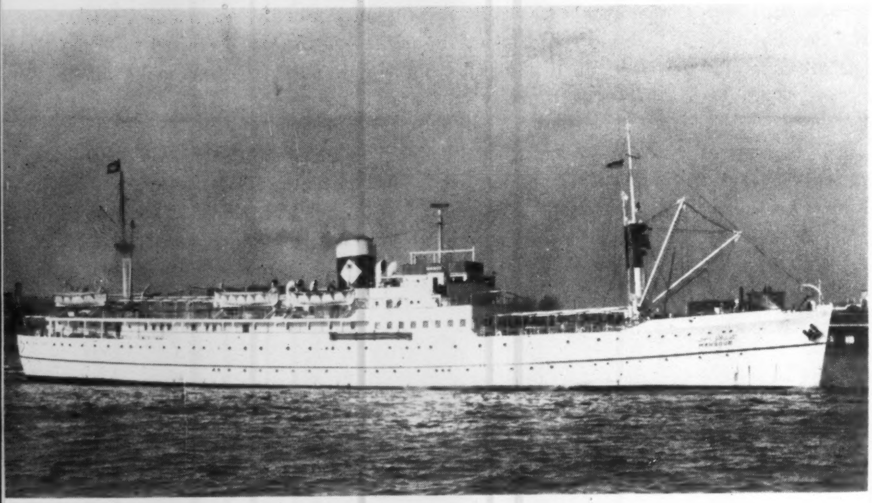
The heating of the water in the storage tanks is confined to the off-peak period in order to qualify for the lowest electricity tariff. This period is 7 p.m. to 7 a.m. at present, but the London Electricity Board reserves the right to vary the period at its discretion.

The load control relay is set manually, the positioning dependent on the outside temperature, the wind, and the building occupancy. With the setting of the load control relay the load that the boiler is to take for that day is thus fixed. Maximum temperature of the stored water is set at 240 F. This temperature is possible because the system is under a static head of 106 ft. This is accomplished by connection to an expansion tank located in the tower of the Senate house.

Thermostats are set at the desired hot water temperature required for heating under the prevailing conditions, and the plant is shut down when that condition is reached. It is placed in operation again automatically when the water temperature falls below the designated degree. A safety thermostat is installed in the boiler to shut down the operation at a temperature of 270 F.

Circulation for the space heating in the buildings is maintained on a 24 hour operation during the heating season. The temperature of the water for the ceiling pan-

(Continued on page 264)



90 Remote 2 Ton Units Condition Saud's Royal Yacht

In addition to the 90 ceiling type air conditioning units, which use water as the cooling medium, 10 cabinet unit heaters equipped with chilled water coils are installed. Two 100 ton compressors supply the chilled water. Sea water is used in corrosion resistant condensers.

BY K. F. WENNIK
Modine Mfg. Co.

AIR CONDITIONING installations serve some of the world's finest structures. One of the most sumptuous and challenging is the fabulous royal yacht, S.S. Al-Amir Saud, recently commissioned by the King of Saudi Arabia.

This former Greek luxury liner, originally designed for passenger service, was completely overhauled and redesigned to serve as the King's floating palace.

Measuring 346 ft from bow to stern, it is exquisitely decorated and furnished and completely air conditioned. Operating in areas where the mercury hovers about 122 F, and where temperatures occasionally register 135 F, his royal highness desired his quarters to be cooled to 60 F. Therefore, it was very important that all equipment be selected and sized accurately.

Utilizing water as the cooling medium, 90 ceiling type air conditioning units condition the corridors, lounges, staterooms, and crew's quarters. Each unit is nominally rated at 2 tons in capacity.

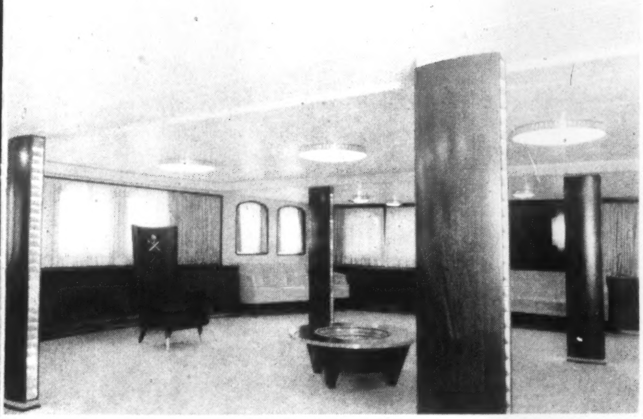
Because of the extreme conditions required in the royal quarters, 10 cabinet unit heaters equipped with chilled water coils, insulated drain pans, and cabinet enclosures were specially engineered and designed to deliver 5 tons of capacity each.

These units are installed in cleverly hidden recesses, with only the inlets and discharge outlets indicating their existence. Quiet operation was of prime importance in the design of this equipment.

Two 100 ton refrigeration compressors supply the chilled water, which ranges from 46 to 56 F.

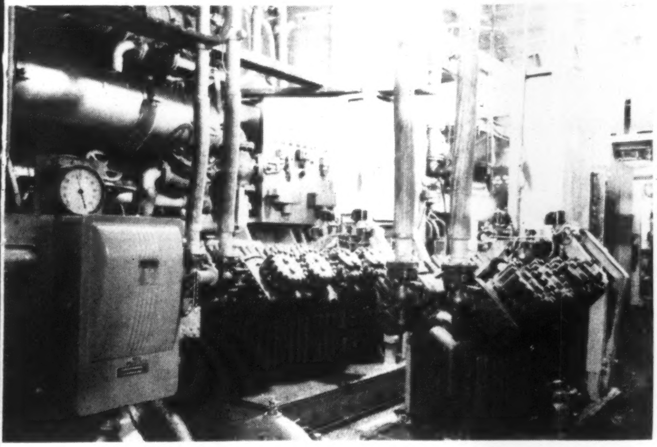
Sea water at a temperature of 86 F is circulated by four, 4 in. double suction all bronze pumps through 16 in. diam special condensers. The special sea water condensers were manufactured with 90-10 copper-nickel tubes and monel clad tube sheets. A condensing temperature of 107 F is maintained by 600 gpm of sea water.

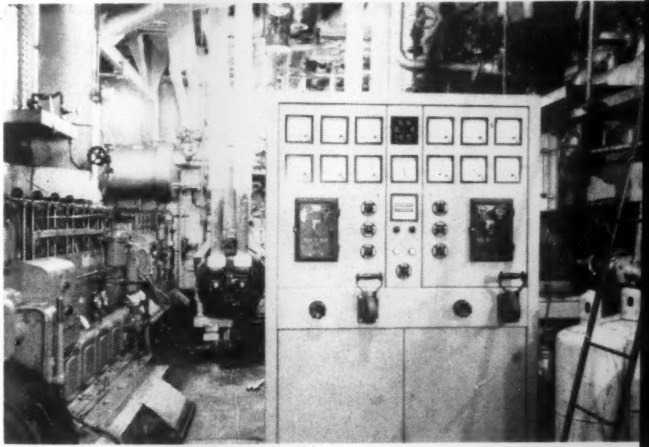
Standard 3 in. double suction pumps circulate 480 gpm of chilled water through a four circuit, 30 in. diam, 15 ft long water chiller to the remote units.



Above: **Throne room and royal bedroom are conditioned by cabinet unit heaters equipped with chilled water coils and insulated drain pans. These units were specially engineered to deliver 5 tons of capacity each to maintain 60 F temperature in King's quarters**

Below: **Two 100 ton refrigeration compressors supply 46 to 56 F chilled water to all units, which are automatically controlled by panel**





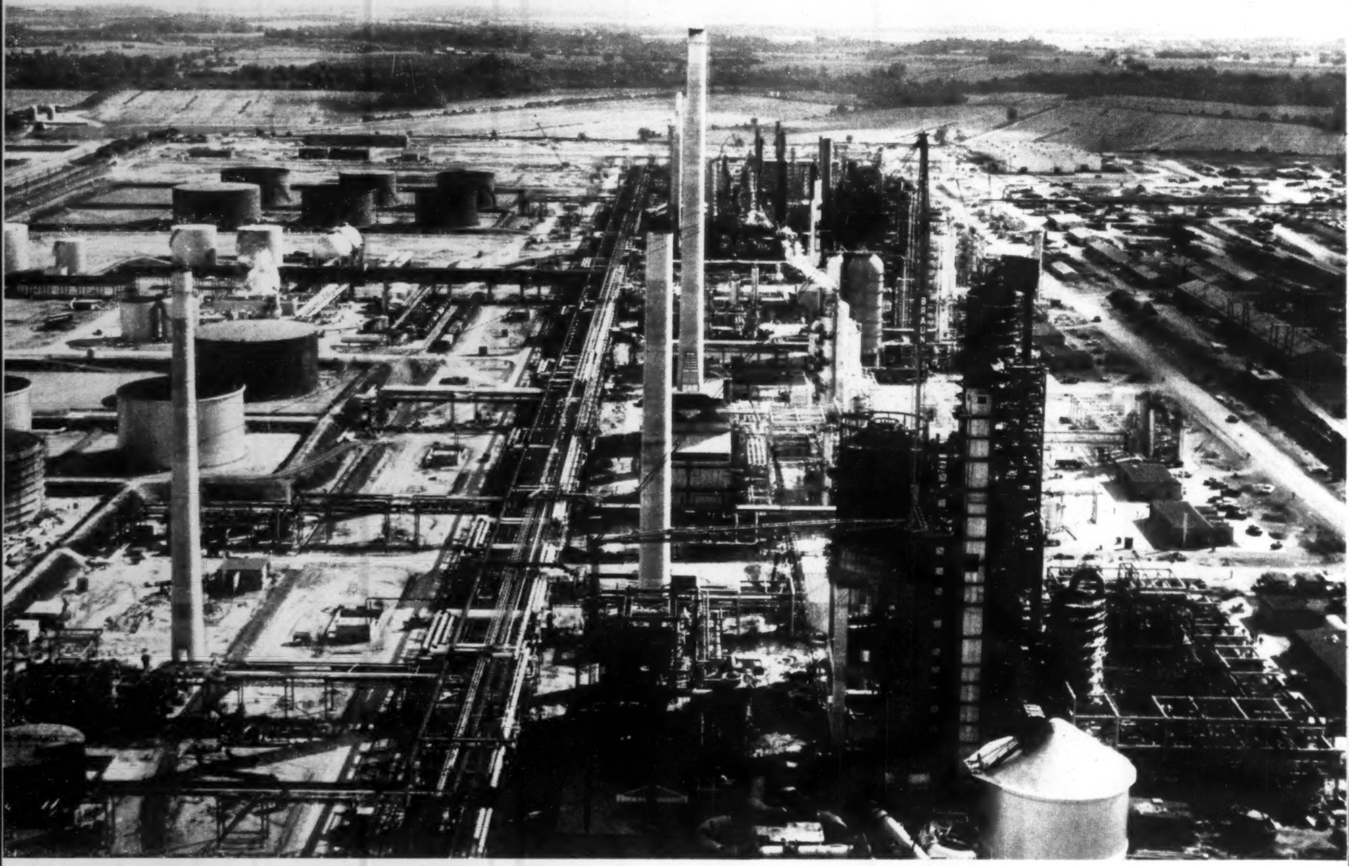
An automatic pneumatic control system composed of special marine duty instruments is employed to provide cooling or heating as required.

Spare parts were purchased for every item of the air conditioning system. Completely assembled units are kept aboard ship to enable an entire replacement of troublesome apparatus and cut downtime to the absolute minimum. Upon reaching the home port, Djeddah, Saudi Arabia, the faulty equipment is then repaired with the aid of the remaining spare parts stored there, and the corrected assembly is again placed aboard ship, this time to be carried as the spare unit.

The system was designed and installed by the Haji Abdullah Alireza & Co. in the Howaldtswerke shipyard in Hamburg, Germany.

Acknowledgment is made to Mr. Stanley Dicker of the Westinghouse Electric International Co. for his contribution of details for this installation.

‡



Construction of this huge new refinery required 1000 miles of pipe, including 30,000 fabricated pipe spools and 100,000 valves. Much of the fabrication was done in a large field pipe shop set up for workers to . . .

Weld 1500 Tons of Alloy Piping

BY J. R. PHARES
C. F. Braun & Co.
Consulting Engineers

THE NEW large Delaware refinery of the Tidewater Oil Co. on a 5000 acre site on the bank of the Delaware river, 15 miles south of Wilmington, has the greatest initial processing capacity of any refinery ever built — 130,000 barrels of crude oil per day.

The most modern methods are used for handling almost every kind of material that will flow through pipe — crude oil, intermediate products, hot vapors, gasolines and kerosenes, oils, sludge, steam, air, refrigerants, water, brine, corrosive chemicals of many kinds, and fluidized solids. The materials are handled at many levels of pressure and temperature, in quantities from cubic centimeters per hour to tons per second.

Building the refinery required vast amounts of material and labor. There are 1000 miles of pipe, including 30,000 fabricated pipe spools. The 100,000 valves used, range from 1/4 in. to 8 ft in diameter. Power flows through 400 miles of underground and overhead lines. Refining processes go on in 1500 principal pieces of equipment. Over 9000 field workers and some $6 million worth of construction equipment were employed at the peak of the project.

Field Pipe Shop Made 24,000 Pipe Spools

A completely staffed and modernly equipped field pipe shop was set up. During its brief lifetime, it had the largest capacity of any such shop in the world. Being close to the job, the shop could fabricate pipe spools that were larger and more complete than those normally transported by common carriers.

The pipe shop turned out 21,000 carbon steel pipe spools, ranging up to 10 in. in diameter — over 800 spools a week from one shift at peak production. While the bulk of the piping was carbon steel, the refinery includes almost every known pipe material, low chrome alloys, stainless steel and monel, alloy clad lines, cement lined breechings, lines with refractory linings, lines of copper and its alloys, nickel and its alloys, glass, plastic, and others.

Arrowing through the heart of the process area like a mile long spinal column is the main pipeway. Forty ft wide and three decks high, it carries 50 miles of pipe up to 3 ft in diameter, and ties all of the process units together into one operation.

Project Required More Than 10,000 Welds

Before it reaches the storage tanks all the crude oil or partly processed product will have passed through almost 250 miles of piping. Included in this pipe fabricating job is more than 1500 tons of fabricated alloy. Approximately 1400 separate pieces, averaging more than a ton apiece in weight and needing more than 20,000 blueprints, were fabricated, with wall thicknesses ranging up to 1½ in. and diameters up to 20 in.

Operational requirements in the refinery include temperature ranges to 1450 F and pressure ranges to 900 psig. In the power plant the operating characteristics are 950 F and 1350 psig.

To meet these requirements, different alloys were fabricated: carbon-moly; 1 percent chrome; 1¼ percent chrome; 4-6 percent chrome; 6-8 percent chrome; 8-10 percent chrome; inconel; monel; incoloy; 99 percent nickel; Type 304 stainless steel; Type 316 stainless steel; and an aluminum alloy.

The project required more than 10,000 welds. Specifications for the job required 100 percent penetration — without the use of backing rings — for all welds. To accomplish this, an inert gas nonconsummable electrode process was used. All butt welds were radiographed; nozzle welds and coupling welds were either magnetic particle inspected or penetrant dye checked.

Fluidized Coke Piped to Power Station

A 500 ft high concrete stack at the end of the main pipeway marks the 40 acre site of the Delaware City power station of the Delaware Power and Light Co. By-product coke from the refinery's fluid coking unit provides fuel for the power station, which in turn supplies the refinery with steam and electric power. This is the first central station designed to operate on fluidized coke.

The coke is cooled at the coker unit, fluidized by aeration, and "airveyed" to the power plant. The airveyor lines have long sweeping bends and smooth transitions to minimize erosion. They run to the power plant along the main pipeway, side by side with the 20 in. and 24 in. main steam headers that bring 540,000 lb per hr of 600 psig steam back to the process area.

36 In. Blowdown Header Is Largest Pipe Line

The largest line on the main pipeway is the blowdown header, a 36 in. diameter pipe which terminates in flare stacks at each end. All volatile gases are vented into this header through safety valves on equipment. Since some of these gases may be very hot, the header has expansion joints at regular intervals, and the pipeway is designed to resist its extremely high thrusts.

Pump 275,000 Gpm of Cooling Water

The refinery lies on a 50 ft rise of ground about 1½ miles inland from the Delaware river. Midway, at the end of a 5000 ft dredged channel, is the intake pumping station for the cooling water system. At the intake station, nine 2000 hp pumps lift water from the river level at the rate of 275,000 gpm. This water circulates through the refinery to cool and condense process streams.

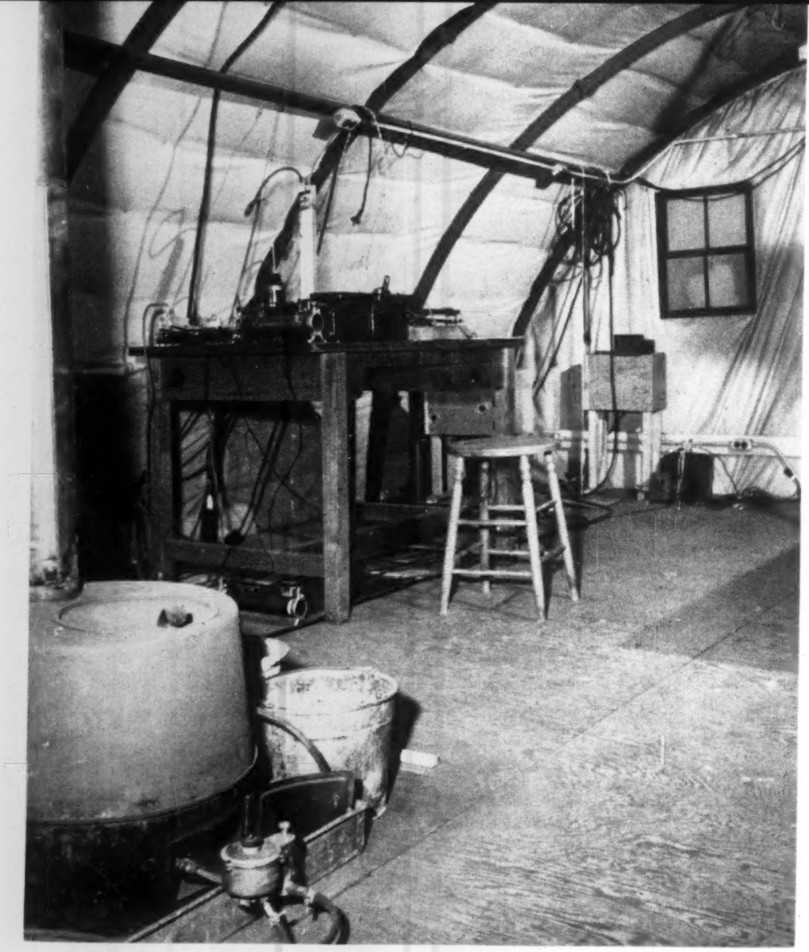
The pumps, among the largest ever built for such a high total head, have internal parts of stainless steel, to protect against corrosion from the brackish river water. They discharge into two 78 in. diameter reinforced concrete conduits at a pressure of 80 psig. Two 20 ft diameter by 80 ft high surge tanks protect the conduit system against damage from waterhammer.

After picking up its heat load in the refinery, the water starts its return trip through two 84 in. gravity culverts. To prevent excessive velocity in the concrete pipe, due to a rapid drop in elevation, the energy of the water is dissipated in large square concrete shafts in which the water falls vertically and releases its energy in turbulence.

The closed culverts discharge into a system of open channels through which the water flows to the river.

The subcontractor for the alloy fabrication was the Flori Pipe Co., a Sparton Corp. subsidiary. ‡

NINE VERTICAL PUMPS of the centrifugal type, driven by 2000 hp electric motors, circulate 275,000 gpm of water from the river to cool and condense refinery process streams



Reflective Wall Lining Reduces Body Heat Loss In Arctic Structure

BY C P. YAGLOU[1], CARLOS E. NEWTON[2], AND DAVID W. MARBLE[3]

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Aluminum paper lined walls and roofs increased temperatures of air and walls in the living zone and reduced overheating — saving 15 percent in fuel — in the upper shelter space by reflecting back into the shelter radiations from the stove, occupants, and lights, in Army tests.

CONVENTIONAL methods of heating arctic buildings are considered unhygienic and wasteful because they produce steep vertical temperature gradients which chill the feet and overheat the upper parts of the body. It is generally believed, on purely theoretical grounds, that the way to promote thermal comfort in arctic structures is not by overheating the air but by achieving a radiative heat balance between occupants and walls, the latter papered with reflective aluminum sheets to act as heat mirrors.

The underlying principle involved is that body heat loss by radiation is impossible in an enclosure having perfectly reflective interior surfaces. Radiant heat from an occupant striking such surfaces would be reflected back to him thus saving much heat to the body. The principal means of body heat loss would then be by convection to ambient air, whose temperature should be much lower with perfectly reflective surfaces than with conventional surfaces of low reflectance. In theory, comfort would be achieved at a small fraction of the heating load of conventional systems. In practice, there is not enough factual data to predict the performance of reflective walls in arctic structures.

The use of reflective wall lining as a means of improving thermal comfort and saving fuel, was studied in a sub-arctic region having an annual mean temperature of 18 F, and a wind velocity of 14.5 mph. Experiments were made in a stove heated Jamesway arctic shelter developed by the Quartermaster General of the Army. This shelter is a prefabricated semicylindrical structure capable of being erected or dismantled in the field by unskilled labor in a few hours. It consists of a box type, glass fiber filled — 2¼ in. — sectional floor, made of 4 × 8 ft plywood sheets, over which are erected lightweight arches covered with 1 in. glass fiber insulated waterproof blankets. The basic unit is 16 × 16 × 8 ft., expandable lengthwise in multiples of 4 ft.

The shelter used for tests was 16 ft wide × 32 ft long × 8 ft high, and had one door and two plastic-glass windows on each end wall. Its overall transmittance value and infiltration characteristics were comparable to those of a conventional uninsulated frame structure, when the shelter side walls were kept free of snow accumulation in the subarctic region. This same shelter served also as living quarters and laboratory. It was modified for the tests by partitioning it at midlength into a "reflective" and a "nonreflective" compartment. The former differed from the latter in that the side walls, ceiling and door, hereafter referred to as "walls," were lined with embossed aluminum paper having a reported emissivity of 0.05, as against an emissivity of 0.90 of the untreated nonreflective compartment used for control.

Heat Shelter with Oil Stove

Each compartment was heated independently by an oil stove — "tent stove" — screened from the subjects, and adjusted to provide thermal comfort for the men who were sitting at small tables, engaging in writing or reading. All but one of the subjects had had previous experience in arctic living, and had learned how to dress in order to alleviate the effects of steep air temperature gradients on the body. In the experiments they wore cotton shorts and undershirt, regulation glass fiber insulated arctic trousers, or heavy army woolen trousers, a woolen khaki shirt, and arctic felt boots or oxford shoes, with one or two pairs of woolen socks. No one wore a jacket.

Test Four Men in Each Room

Experiments commenced in the morning, and were continued through the afternoon until the oral, cheek, hand, and clothing surface temperatures, measured by a thermopile, levelled off. Test and control observations were made simultaneously with four men in each compartment. On the following day, the two groups exchanged compartments, and all measurements were repeated. The outside temperature ranged from −25 F to −34 F and the wind velocity from 13 to 17 mph, at midheight of the shelter.

A summary of results appears in Tables 1 and 2. Although temperatures in the nonreflective compartment reached as high as 93 F near the ceiling, the feet of the subjects were exposed to a temperature of only 48 F, the thighs and waist to 64 F, and the top of the head to 76 F, averaging a mean of 62.7 F over the whole body in the sitting position, as shown in Table 1. Despite these low ambient temperatures, the men were not uncomfortable, partly because they dressed properly, but mainly because they were receiving radiation from the screened stove, stove pipe, lights, and walls, aggregating almost as much as the men were emitting to the environment. This is indicated by a mean radiant temperature of 77.3 F — computed from globe thermometer readings — and a mean clothing surface temperature of 78.7 F, differing by only 1.4 F, as shown in Table 1.

A black globe thermometer exposed to a radiant environment physically integrates the temperature, radiation, and air movement into a single temperature value, connoting an equivalent dry bulb temperature of a hypothetical environment with air and walls at the same temperature, no radiation, and practically still air. The equivalent temperature shown by the globe thermometer was 73.4 F, which differed but little from comfort values established in temperate regions of the continental U. S. with conventional heating.

Here Are the Basic Facts Learned from the Study

1) The acceptable equivalent temperature in a stove heated arctic shelter would seem to differ but little from that in conventionally heated buildings of the continental U.S., when radiation, air stratification, drafts, and other factors are taken into account by the use of a standard black globe thermometer, instead of the ordinary air thermometer, which is an inadequate measure of comfort heating in the arctic.

2) In the presence of strong radiation, as from a stove, the globe thermometer roughly integrates the radiation-convection characteristics of the environment into an equivalent dry bulb temperature, which appears to be the same in the sub-arctic as in the temperate zone—72 to 74 F—, under acceptable thermal conditions, although the ambient temperature for the occupants and globe can be as low as 63 F in the sub-arctic.

3) The principal channel of body heat loss in a stove heated arctic shelter is by convection. Radiation from the stove raises the mean radiant temperature to within 1 or 2 F of the mean clothing surface temperature, thus producing a condition of radiative heat balance without necessarily using reflective insulation, but with much overheating in the upper parts of the shelter when reflective insulation is not used.

4) The chief advantage of reflective wall lining is its ability to increase low air and wall temperatures in the living zone, and to reduce overheating in the upper shelter space by reflecting back into the shelter radiations from the stove, occupants, and lights. In the absence of reflective lining, these radiations are mostly absorbed by the walls and lost by conduction to the outside.

5) From this and other experiences, it is concluded that one method of heating small buildings in the arctic is by stove with a small bracket fan near the ceiling for mixing the air, wherever electricity is available. The apparent disadvantage of overheating in the vicinity of the stove becomes a distinct advantage in the arctic, by providing a hot space for quickly rewarming chilled personnel after working out in the cold, thus shortening the agony from shaking chills, and increasing the length of outdoor exposure.

TABLE 1—THERMAL CONDITIONS in the two compartments yielded approximately the same degree of comfort in seven subjects. Outside conditions were as follows: mean temperature, −27 F; relative humidity, 100 percent; wind, 15 mph

	Nonreflective Room		Reflective Room	
Globe temperature, F, at 3 ft level	73.4		72.6	
Mean radiant temperature, F, at 3 ft	77.3		76.2	
Air movement at 3 ft, fpm	45		65	
Relative humidity, natural, at 3 ft, percent	27		29	
Mean clothing surface temperature, F	78.7		78.5	
Height above floor, ft	Mean air temperature, F	Mean wall temperature, F	Mean air temperature, F	Mean wall temperature, F
7.5	93.0	76.0	84.0	78.0
6.0	86.0	73.0	81.0	64.0
4.0	76.0	62.0	75.0	52.0
2.0	64.0	42.0	66.0	46.0
0.2	48.0	32.0	53.0	42.0
Straight averages				
0.2 to 4.0	62.7	45.3	64.7	46.7
4.0 to 7.5	85.0	70.3	80.0	64.7
0.2 to 7.5	73.4	57.0	71.8	56.4
Averages by area				
Air	77.4	—	74.2	—
Floor	—	59.0	—	63.0
Walls	—	61.2	—	58.0

Insulation Improves Conditions

Apart from evaporative heat loss due to insensible perspiration, almost all of the bodily sensible heat was lost by convection to ambient air at about 63 F, moving with a velocity of 45 fpm, measured by thermo-anemometer. In fact, an approach to radiative heat balance was achieved by radiations from the stove and surrounding surfaces without reflective wall lining, but with a significant penalty for the overheating of the upper shelter space.

The lining of "walls" with aluminum paper apparently decreased the air temperature near the ceiling from 93 F in the nonreflective compartment to 81 F in the reflective, and increased the air temperature at the 2 in. level respectively from 48 to 53 F, as shown in Table 1, resulting in an overall gradient reduction of about 30 percent. The mean floor surface temperature was 59 F in the nonreflective compartment, and 63 F in the reflective, while the mean "wall" surface temperature was 61.2 and 58 F, respectively, in the two compartments.

The ambient air temperature to which the subjects were exposed averaged 2 F higher in the reflective compartment — 64.7 F — than in the nonreflective — 62.7 F — but the air movement was also higher — 65 fpm compared to 15 fpm — tending to counteract the 2 F benefit.

Although subjective sensations of warmth and mean clothing surface temperatures differed but little in the two compartments, as shown in Table 2, the men never were entirely comfortable by American standards. Most of the complaints were due to cold feet. In the reflective compartment, drafts on the shoulders and back also caused considerable annoyance.

TABLE 2—MEAN SURFACE TEMPERATURES of clothing and exposed skin in relation to sensations of warmth experienced by subjects differed little between the two rooms

	Nonreflective Room		Reflective Room	
Mean ambient air temperature, F	77.3 45		64.7	
Mean radiant temperature, F	62.7		76.2	
Air movement, fpm			65	
Body segments	Body surface temperature, F	Sensation of warmth	Body surface temperature, F	Sensation of warmth
Head	93.8	Comfortable	93.8	Comfortable
Trunk	81.3	Cool to cold	80.0	Cold
Arms	76.9	Comfortable	77.2	Comfortable
Hands	86.0	Comfortable	89.1	Comfortable
Legs	74.9	Comfortable	74.1	Comfortable
Feet	65.9	Cold	69.5	Cool to cold
Weighted mean	78.7		78.5	

Lack Comfort at Low Activity

It is clear that, although a condition of radiative heat balance practically was approached in the cool living zone of the stove heated arctic shelter, true thermal comfort could not be achieved at ambient temperatures of 50 to 65 F with a low level of physical activity. This is not a casual observation based on the present study only, but represents the general experience of test teams living at the site for about three months every winter from 1950 to 1954.

The explanation probably lies in the fact that there is not enough heat produced in the resting feet, nor is there enough blood circulation in vasoconstricted feet, to keep them warm enough at low temperatures, regardless of the amount of insulation worn in the foot gear. These points are often overlooked in short time laboratory experiments with reflective insulation.

Cut Fuel By 15 Percent

Fuel consumption was about 15 percent lower in the reflective than in the nonreflective compartment. All of these small, but distinct, benefits of aluminum lining resulted largely from reflecting back in the shelter radiations from the stove, occupants, lights, and other sources of heat. In the nonreflective compartment much of this radiation was absorbed by the walls and lost by conduction to the outside.

Although the results of this study fail to confirm fantastic claims sometimes made for reflective insulation, they are well in accord with studies at the John B. Pierce Laboratory of Hygiene, and at the University of Minnesota. Failure to achieve greater benefits is ascribed partly to deviation of practice from theory in full size rooms as opposed to small experimental cubicles, and partly to steep temperature gradients and drafts which counteract much of the radiation effect, and tend to increase fuel consumption. In this respect, the reflective compartment would seem to have been at a disadvantage because it faced the prevailing direction of the wind. However, it is believed that this disadvantage was partly or wholly counteracted by the extra insulation offered by air pockets between the aluminum lining and walls.

The work described in this article is part of a broad habitability study in climatic extremes supported by the Office of the Surgeon General, Department of the Army, and conducted by the Army Environmental Health Laboratory in cooperation with the Harvard School of Public Health, under sponsorship of the Commission on Environmental Hygiene of the Armed Forces Epidemiological Board.

Personnel participating as subjects were George Lee, gas analyst, Harvard School of Public Health; Cpl. M. H. Mauk, Cpl. C. F. W. Haack, and Cpl. A. R. Miller, Army Environmental Health Laboratory, and Cpl. R. L. Keller, and Pvt-2 W. R. Ferguson, Walter Reed Army Medical Center.

Drafts Hard to Control

It is difficult to control drafts in arctic shelters exposed on three or four sides. These drafts are produced by steep temperature gradients, and by high winds and temperature differentials, which shrink walls, and warp floors, doors, and windows, creating sizable cracks for infiltration, even in permanent buildings.

Other limitations to the use of reflective insulation were visual glare, and possible aggravation of condensation problems by reduction of vapor permeability of walls. Partial reflective insulation above the line of vision resulted in less glare, but at the same time reduced the radiation benefits. The painting of surfaces with flakey aluminum paint was less effective than the lining.

Experiments made in Boston at night time or on overcast days when the outside temperature ranged between −5 F and +15 F, showed that a stove heated Jamesway shelter can be made more comfortable by the use of a bracket fan near the ceiling for mixing the air than by lining its walls with aluminum paper. The air temperature gradients from floor to ceiling depended much more on the method of heat distribution than on outside temperature. Unfortunately, electricity rarely is available in the arctic or sub-artic except in well developed areas. ǂ

ON THE JOB

Kitchen Separately Conditioned at Swank Eatery

. . . by central station unit; compressor system serves dining areas

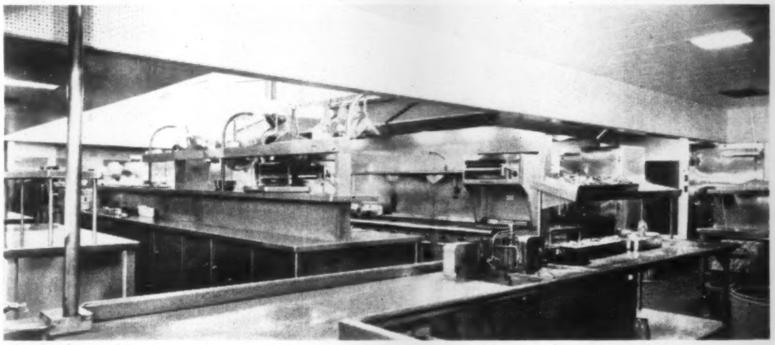
Air conditioned dining areas in restaurants are not unusual, but comfort cooling in kitchens is.

However, when the question of air conditioning for his kitchen was presented to George Barraclough, president of the swank, $1.5 million Barraclough's restaurant in Los Angeles, he never batted an eyelash, according to The Trane Co.

The restaurant seats about 400 people.

Actually, the air conditioning project was regarded as an investment by the Barracloughs, who view reduced absenteeism, improved efficiency, and high employee morale as the basis for sound financial return.

Two 50 ton compressors provide sufficient comfort cooling for everyone.



Ceiling diffusers distribute the cooled air to every part of the interior, without draft or cold spots. Outside air and return air are mixed, filtered, cooled, and distributed completely automatically, with the chiller providing only the amount of cooling actually demanded by the load at a particular time.

In accordance with a Los Angeles ordinance, fire damper controls are installed in each ceiling duct. This is necessary because of the close proximity of the ceiling and roof.

The kitchen is air conditioned by its own separate system. The system takes in outside and some return air, combining both quantities to make up for exhausted air. Cooking fumes are vented directly to the outside.

The air conditioning contractor was Mehring and Hansen. ǂ

New Foam System Blankets Fire

FIRE FIGHTING FOAM — a 6 percent solution of a protein base compound — is formed and discharged in a spray pattern when a mixture of the foam compound and water reaches the sprinklers

VOLUMINOUS FOAM quickly covers large areas, boxing in and blanketing intense fires that could develop from a major spill of aircraft fuel

BY C. F. AVERILL
Manager
Special Hazards Dept.
Grinnell Co., Inc.

THE FOAM-WATER SYSTEM is a new approach by the fire protection industry to cope with the ever increasing fire hazard in present day aircraft hangars. This hazard is compounded by the unusually large areas constituting a fire area, the large volumes of flammable liquid which of necessity are brought into these areas, and the expanse of the horizontal surfaces which would shield a fire on the floor from other types of protection. The high cost of both the buildings and the aircraft, together with their importance to national defense and commercial progress, made it necessary to develop a better means of protecting this investment.

Foam Enables Crew to Approach Fire Source

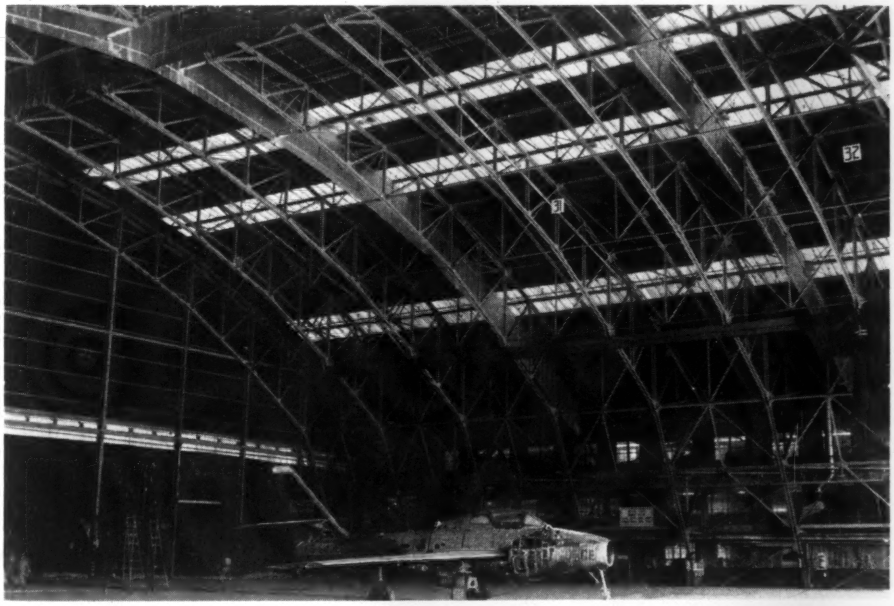
The foam-water sprinkler system has the ability to discharge large volumes of foam over large areas quickly, thus boxing in and blanketing the intense fires that could develop from a major spill of aircraft fuel. The foam is fluid enough to flow horizontally, thus forming a blanket over the floor areas under the wings and fuselage that are shielded from the direct discharge. This extinguishes or controls the large spill fire so that the fire fighting crews are spared the time-consuming and punishing task of fighting their way to the source of the fire, making it possible for them to attack any fire within the aircraft much more quickly and effectively.

While this article deals specifically with installations in aircraft hangars, this same type of protection has many applications in industry where large volumes of highly flammable liquids are present.

45 Sprinkler Systems Installed at Air Base

Foam-water systems were recently installed at the Warner Robins Air Force Base near Macon, Ga., under the supervision of the Corps of Engineers for the Air Materiel Command, to protect two buildings. The first is approximately 200 ft by 630 ft divided into two hangar sections, with an office space in the center. Each hangar section is approximately 200 ft by 275 ft with a monitor roof. The monitor elevation is 76 ft and the low roof elevation is 57 ft. Roofs are of 2 in. combustible wood decking on 4 in. by 12 in. steel purlins.

. . . in aircraft hangars, industrial plants, and other areas where large volumes of flammable liquids are used or stored



5897 FOAM-WATER SPRINKLERS — similar to standard sprinklers — are installed under the roofs of two hangars at Robins Air Force Base near Macon, Ga. In case of fire, a rapid rise in temperature at the roof causes air in one or more heat detectors to expand and build up pressure, which is carried through $1/8$ in. copper tubing to a diaphragm in the deluge valve release mechanism. For each deluge valve there is a companion deluge valve — interlocked pneumatically and electrically — which controls the flow of foam compound

There are 12 foam-water sprinkler systems in this building. Six systems are in each of the two hangar sections.

The second building is approximately 600 ft by 800 ft. divided into four hangar docks and two shop areas. Each dock is approximately 200 ft by 300 ft with an arched roof, the high point being 90 ft, and the low point, 39 ft. Roofs are of corrugated steel on 4 in. by 12 in. steel purlins.

The shop areas have shed roofs with a high point of 50 ft and a low point of 39 ft. The roof is 2 in. combustible wood decking on 4 in. by 10 in. steel purlins.

There are 33 foam-water sprinkler systems in this building. Six systems are in each of the four hangar docks; four systems are in each of the two shed roof shop areas, and one system is in the paint shop.

Foam Discharge Controlled By Deluge Valves

Each system has an average of 130 foam-water sprinklers. A total of 5897 foam-water sprinklers are installed under the roofs of the buildings similar to standard sprinkler systems. Each head covers an average of 80 sq ft of floor area. The foam-water sprinklers are open, that is without fusible elements, and the discharge is controlled by automatically operated supervised rate of rise deluge valves.

Pneumatic heat detectors are under the roofs throughout the protected areas. A rapid rise in temperature at the roof, due to fire, would cause the air in one or more heat detectors to expand and build up a pressure which would be carried through $1/8$ in. copper tubing to a diaphragm in the deluge valve release mechanism. Movement of the diaphragm causes the deluge valve to open, allowing water to flow into the piping and discharge from all the foam-water sprinklers under the control of that particular deluge valve.

Each deluge valve which controls the water flow has a companion deluge valve controlling the flow of foam compound. When the water deluge valve opens, the compound deluge valve is also opened by a pneumatic and electric interlock.

. . . even distribution of water is essential

The foam compound flows through a metering orifice which allows the proper amount to enter the water stream. When this mixture reaches the foam-water sprinklers, foam is formed and discharged in a spray pattern.

The location and spacing of the foam-water sprinklers were engineered to conform to the standards for deluge sprinkler systems, as set forth in the National Fire Protection Association pamphlet No. 13, and foam-spray systems for aircraft hangar protection as set forth in NFPA pamphlets No. 409 and No. 16.

The detecting systems are of the pneumatic rate of rise type and are completely supervised by air at 1½ psig pressure. An air leak in the detecting system would cause a loss of the supervisory pressure. This loss of supervisory pressure would indicate trouble by the lighting of a red lamp at the particular deluge valve in trouble and also give a trouble signal through an alarm supervisory system. Monitor switches on the principal gate valves are also tied into this supervisory system.

The water supply consists of a 500,000 gal steel reservoir above grade adjacent to the pump house. Four Underwriters' listed gasoline engine driven fire pumps rated at 2500 gpm at 100 psig take suction from this reservoir. The first water pump is started by water flow through any deluge valve. This is accomplished by a water flow switch on the deluge valve. The other three water pumps start automatically and sequentially as demand for more pressure, caused by additional systems operating, occurs.

The underground supply piping, connecting the pump supply to the foam-water sprinkler systems is maintained at approximately 60 psig pressure through a checked cross connection to the base yard mains.

Compound Stored in Four 8000 Gal Tanks

The foam compound supply consists of 32,000 gal of 6 percent protein base foam compound which meets the requirements of joint Army-Navy Specification C-266. The compound is stored above grade in four 8000 gal tanks; two are located at each building. The amount of compound in one tank is sufficient to supply six systems, which is the maximum number expected to operate, for a period of 10 minutes. The second foam compound supply tank for each building provides a reserve supply. There are four 750 gpm centrifugal electric driven compound pumps, two for each building. One pump takes suction from an individual compound storage tank and the second serves as a standby.

The compound pumps are started automatically by a drop in pressure in the compound piping. A pressure of 140 to 160 psig is maintained in the compound piping to the deluge valves by a hydro-pneumatic tank; air is supplied to this tank by a small air compressor.

Pressure at All Sprinklers Approximately Equal

In order to get the most efficient use of the water consumed, it is essential to have even distribution of the water throughout the area protected. This is accomplished in two ways: first by using a foam-water sprinkler with good distribution characteristics, and secondly by designing the piping system so that there is approximately the same pressure at all heads.

The distribution from the foam-water sprinkler was designed into it during the development work for the device and remains fixed for all installations. The piping system is different for each installation, and therefore, must be specially engineered for the building.

Experienced engineers can usually accomplish even distribution by hydraulically calculating the pipe sizing. Restriction orifices are sometimes used but should be avoided where possible.

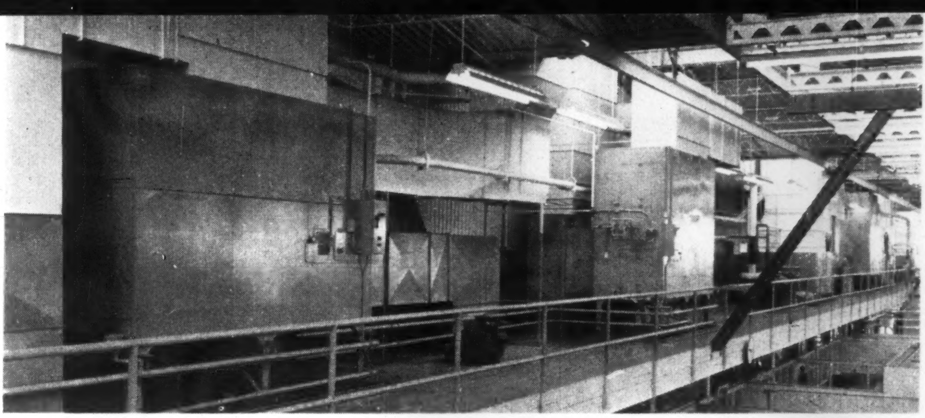
Special Problems Encountered

One of the special problems encountered in the design of systems for aircraft hangars is caused by a variation in the volume of water flowing through the piping system. In the case at Robins Air Force Base, a small fire may actuate only one system, resulting in a flow of approximately 2000 gpm, whereas a large fire may actuate as many as six systems, resulting in a flow of approximately 12,000 gpm. Of course, any number of systems between these limits could operate, and the losses in the piping must be such that equal pressures are maintained at the heads not only within a system but within a group of systems.

The piping carrying the concentrated foam compound from the source of supply to the point of injection into the water stream also presents special problems, especially where these pipe runs are long. There is not only the variation in volume flowing due to the number of systems operating, but the viscosity of the compound changes radically with changes in temperature. All these factors must be considered for proper proportioning.

The heart of the system is the metering orifice which determines the amount of foam compound passing into the water stream. The systems at Robins Air Force Base were designed for the use of 6 percent compound. That is, for every 94 gal of water, 6 gal of compound must be mixed with it. The specifications allowed for a variation of from 5 percent to 7 percent which are reasonable limits. Here again, the variation in pressure caused by changes in flow requirement of both water and compound create the problem.

During actual flow tests held at Robins Air Base, the pressures at the heads and other critical points in the systems checked very closely with the calculated values, and the proportion of foam compound to water was within specified limits under all conditions. ‡



425 ton capacity air conditioning system on a long, narrow deck . . .

Conditions Plant Office Building

BY J. S. HAMEL
Consulting Engineer

Rocketdyne is a new $3 million rocket engine research and development facility of North American Aviation, Inc., at Canoga Park, Calif. It has two basic areas: (1) A 210,000 sq ft factory type area, with 25 ft high clear and with 11 ft high sawtooth north exposure glass on 60 ft wide bays. Continuous, motor operated ventilating sash at the top of each sawtooth provides good natural ventilation. (2) A 100,000 sq ft air conditioned one story office and engineering area adjoining the plant.

Two 150 hp gas-oil fired boilers supply steam for heating and process work. The plant area is heated by steam coil and centrifugal fan units about 30 ft above the floor in the sawtooth roof sections near the windows. Nozzles direct the air to the floor for heating in winter and air circulation in summer.

The air conditioned office and engineering space is unique in several ways. A mezzanine, constructed the length of the common wall between plant and office areas and over a main plant aisle, provides a continuous 15 ft wide, 420 ft long deck on which all of the refrigeration and air handling equipment is installed.

Executive offices are conditioned by means of a 12 zone system that consists of steam coils for heating and chilled water coils for cooling that are supplied from a central water chiller of 100 tons capacity.

In the engineering area an IBM computer is in a separate zone with a 75 ton unit and multizone conditioner to maintain 24 hr constant wet and dry bulb temperatures to extremely close tolerances. The multizone air conditioner is equipped with steam-pan type humidifiers for accurate control of relative humidity.

The balance of the office area — two 40,000 sq ft open areas — is divided into six zones, each with a vertical air conditioner with heating and cooling coils. The refrigeration is supplied by two 125 ton compressors.

A pneumatic control system provides automatic control from cooling to heating, with provisions for modulated outside air according to seasonal requirements.

Several features are as follows:

1) All equipment is easily accessible for maintenance. Each unit is set on 24 in. legs to permit natural condensate drain.

2) Evaporative condensers on the mezzanine provide a 50,000 cfm exhaust system in warm weather for general plant ventilation.

3) The use of large cfm capacity air conditioning units resulted in a simplified duct system wholly within conditioned areas. The amount of return air ductwork is negligible since the units are adjacent to the wall between the mezzanine and the conditioned spaces.

4) The offices and engineering areas in general have open frame construction. The gypsum roof poured on 1 in. thick prefinished glass fiber panels provides an insulation barrier and a white ceiling.

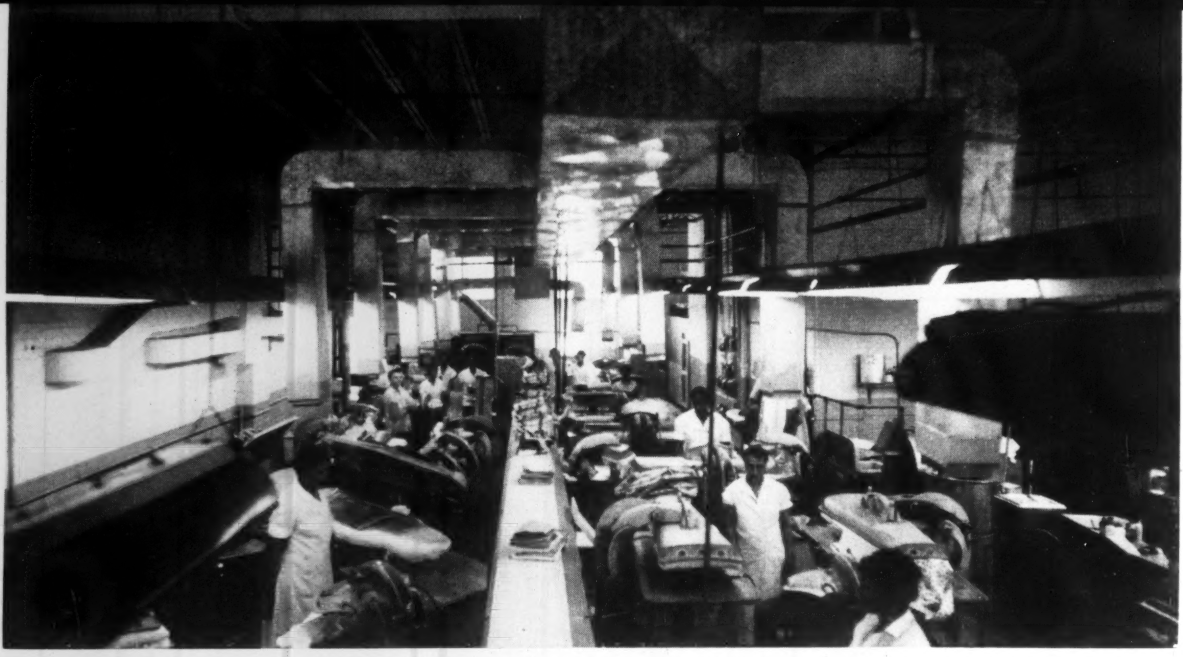
5) Coordination of the structural system with the air conditioning in early design stage resulted in the use of 60 ft span tapered steel girders designed so that the duct mains pass through the girders at the deepest point at the center of each span, resulting in all ducts being above the bottom chord and above uniform rows of fluorescent lighting fixtures.

The diffusers are all of one size, in general square, with a surrounding 12 in. wide sheet metal plaque. By test prior to final design it was found that for the desired wide spacing of the diffusers, the air temperature distribution pattern was greatly improved by the 12 in. wide plaque. The resultant air movement was ideal and a no-draft cooling effect was achieved. Adjustable vanes on the exterior of each diffuser permitted tailored field adjustment.

The cost of this system was about $1.70 per sq ft. Comfort conditions are maintained inside with the outside dry bulb temperature at 105 F or above and wet bulb at 76 F.

The architect was Kenneth H. Neptune, A.I.A. ‡

Photo courtesy Drayer-Hanson



AIR SUPPLY DUCTS deliver spray cooled 100 percent outside air to heat concentrated areas at 800 cfm per worker station in this pressing room. Discharge velocity is about 1000 fpm

Air Washer Type Evaporative Coolers Reduce High Heat Loads

. . . in laundering, cleaning establishments, clothing factories, and similar plants. Outside air, though unrefrigerated, is delivered at diffuser temperatures from 75 to 85 F, even with high outdoor temperatures prevailing. "Spot cooling" via individual duct extensions is recommended for "hot spots," while "free air delivery" is satisfactory for noncritical areas. Good exhaust is essential.

BY B. P. EDELMAN
President
Alton Manufacturing Co.

IN APPLICATIONS with extreme high sensible heat loads, cooling by means of refrigeration is usually out of the question because of the very high initial and operating costs. In recent years, the use of air washer evaporative coolers for such applications has been gaining more and more favor because they have proved able to provide satisfactory comfort cooling while being economical to purchase, maintain, and operate.

In a large number of industrial applications, including laundries and dry cleaning plants, these air washer cooling systems are delivering air, though unrefrigerated, at diffuser temperatures from 75 to 85 F, even with high outdoor temperatures prevailing. It is possible now to maintain comfort conditions combined with 100 percent outdoor air ventilation in areas which heretofore were considered unsuitable for workers to remain in during summer conditions.

A properly designed air washer evaporative cooling job requires the use of all outside air, without any recirculation from within the cooled space. In many instances, direct or "spot cooling" is the most practical method of air distribution. This is true especially in buildings having extremely high ceilings or relatively few workers in a large area where it would be impractical to attempt cooling the entire space. This is true also in plants which have so-called "hot spots" in which it is imperative to bring cooling just to those areas. In such cases, ducts can discharge the air directly to each worker, thereby cutting down on the capacity of the system required and assuring cooling only at those critical places.

It should be kept in mind that in many applications — such as in laundries and dry cleaning plants — the internal heat built up by the machinery can be much worse even than the outdoor heat. Many times, the load figured for refrigeration design will be three or four times over a normal commercial application that does not have this kind of heat-emitting machinery. With the air washer cooling installation using large quantities of outside air, all of which is drawn through the cooling equipment and delivered at high velocities to those points where cooling is required, this internal heat problem is not too serious. It can be easily overcome in most cases at a very reasonable cost.

This type system requires adequate exhaust of the air to the outside, whether by mechanical means or natural exhaust through open doors, windows, or transoms. Most industrial plants have exhaust fans installed at various points in the building; if so, these can be used in conjunction with the supply air system to provide a "push-in, pull-out" system. Exhaust through open windows and doors is usually adequate but can be supplemented to advantage by the use of exhaust fans.

One 12,000 Cfm Unit "Spot Cools" 12 Stations

A system of "spot cooling" was installed recently in the Flowers laundry, Atlanta, Ga. The laundry building is 50 ft × 100 ft overall, but as the workers were to be "spot cooled" only, the installation was designed to use just one 12,000 cfm air washer unit. This unit is powered with a 3 hp motor to run the blower, and a 1/3 hp motor operates the water distribution assembly. The water assembly functions both to recirculate the water and to forcefully spray the filters in the machine to keep them continuously wetted down for greater efficiency. Very little water is actually wasted in view of the recirculation process employed.

In the Flowers laundry there are 12 worker stations being cooled. The job was designed to supply 800 to 1000 cfm to each worker through an adjustable deflector above each work station. These deflectors are 10 × 12 in. with four way adjustable blades. If desired, the worker can adjust the blades to deflect the air away, but most workers prefer having the air blown down over them.

A single large supply duct measuring 31 × 25 in. carries air from the unit — on the roof in the center of the building — down the center of the room directly below the ceiling. From this main duct each 12 × 10 in. take-off carries over to a point about 7 ft above the floor. An adjustable deflector is in each of these individual take-offs. No special problems were encountered since the main duct was kept high up under the ceiling and the individual take-offs were arranged so as to avoid any piping or other obstructions.

Maintenance of the Flowers laundry unit is relatively simple. The regular plant serviceman watches the unit and performs the usual maintenance services such as draining the tank and refilling it with water once a week, oiling bearings in the motors and fan shaft, and checking the belt tension occasionally.

The owner reports very little increase in his utility bill. Actually, the electrical cost on the installation was figured not to exceed $1.00 per day of eight to 10 operating hours. The water charge under most conditions would be $2.00 per month or less.

For this same application, it was estimated that 10 to 15 tons of refrigeration would have been required.

The system can be designed for what is called "free air delivery," that is without ductwork. Many times this proves just as satisfactory as the air delivery can be arranged to discharge the air to the workers in such a way that the air will be exhausted from behind or over the machines, to the outside.

An interesting installation of this type was completed not long ago by Sunshine Launderers & Dry Cleaners in Oshkosh, Wis. For this 15,000 cu ft building a 12,000 cfm air washer is installed. The machine is on the roof, with the main supply duct coming down through an existing skylight. This duct is split so as to discharge air both to the west and east walls of the room. In addition, however, three more small outlets were taken from the main duct, one discharging toward the silk finishing department, one to the assembly and inspection department, and the third toward the pressing department near the center of the building. There are no take-offs of ducts from the main supply duct, but these five diffusers point toward the directions or positions in the room where the cooling is needed.

Installation of the entire system required less than one week.

There are no set rules for the proper cooling of a laundry or cleaning plant since each plant should be studied and taken care of as needed. As a general rule, a system of "free air delivery" will be satisfactory as long as the throw of air from the deflector outlet will not have to exceed 30 ft. However, in exceedingly hot areas, such as pressing and ironing departments, it is generally best to try and use a method of "spot cooling," since then only the air requirements of each individual worker station needs to be figured rather than the entire area of the room or department being cooled.

Many installations are being made with a combination of the "free air delivery" and the "spot cooling" methods.

Four General Rules Guide Design

Here are some general rules that may be used as a guide in designing a cooling system of this type for an industrial application whether it be in a factory, cleaning plant, laundry, garment factory, or similar plant.

1) On "free air delivery" systems, provide one complete change of air per minute or minute and a half.

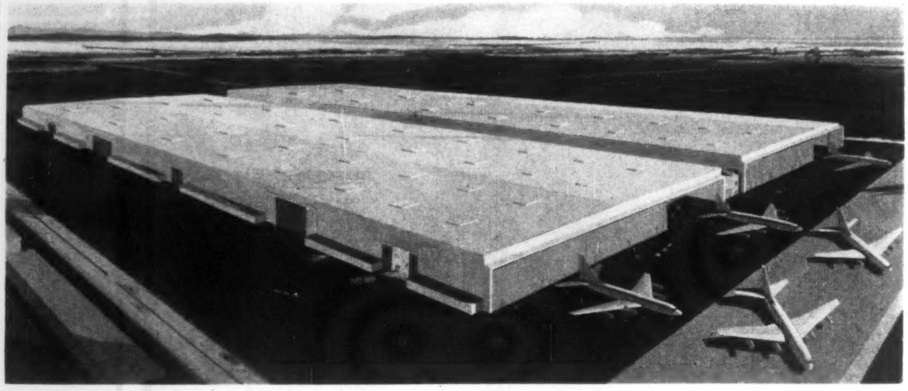
2) Discharge velocity must be relatively high — from 1500 fpm to 2000 fpm in general.

3) Adequate exhaust, whether by mechanical means or natural openings, should be carefully checked. Without good exhaust the system is likely to fail.

4) "Spot cooling" is best in concentrated heat areas such as pressing rooms. Where used, about 800 cfm per worker station is suggested, with the air being directed at the worker. ≠

First HTHW Job on Pacific Coast Heats New Douglas DC-8 Plant

BY DONALD T. ROBBINS
Chief Design Engineer
and
HAL BATEMAN
Mechanical Engineer
Holmes & Narver, Inc.
Engineers-Constructors



OVER 1 MILLION SQ FT IN AREA, new jet airliner assembly plant shown here in artists' sketch will be heated by hot water at 400 F, 300 psig

THE FIRST high temperature, high pressure hot water heating system to be used on the Pacific Coast is installed in the new Douglas DC-8 jet transport assembly facility at Long Beach, Calif. Designed to operate at 400 F, the system provides space heating for the plant, which totals over 1 million sq ft of floor area. Plant construction is scheduled to be completed this month. The first jet airliner is to fly in 1958.

The new plant is among the largest of its type in the U.S. and is the first in the nation to be built for the exclusive manufacture of commercial jet transports. Construction cost has been estimated at $15 million.

The main plant is actually composed of two units called the structures assembly and final assembly buildings. Between them are two story shop services buildings. The plants were divided for fire safety rather than to meet structural or architectural requirements.

The main plant buildings are of hangar type, framed with structural steel. Walls are of protected metal or corrugated aluminum over glass fiber insulation board. The roof is metal deck on steel framing, covered with insulation and built-up roofing.

The larger of the two buildings contains three equal bays of 160 ft divided by steel columns. The smaller building has two bays, one of 200 ft and one of 160 ft. Both buildings are 1144 ft long. Total floor space, over 24 acres, could accommodate 18 football fields or 10,000 automobiles. Or seven ocean liners the size of the Queen Elizabeth could be berthed side by side, four of them in the larger building alone.

The heating system, to qualify as a partner of the DC-8, had to satisfy the most rigid standards by providing the highest quality at the least acceptable cost. Minor consideration was given to the use of a thermal liquid as a heat conveying agent operating at a temperature of 700 F.

As this plant has no requirements for high pressure process steam, and as the available temperature drop could not be economically utilized, no further consideration was given to the use of a thermal liquid.

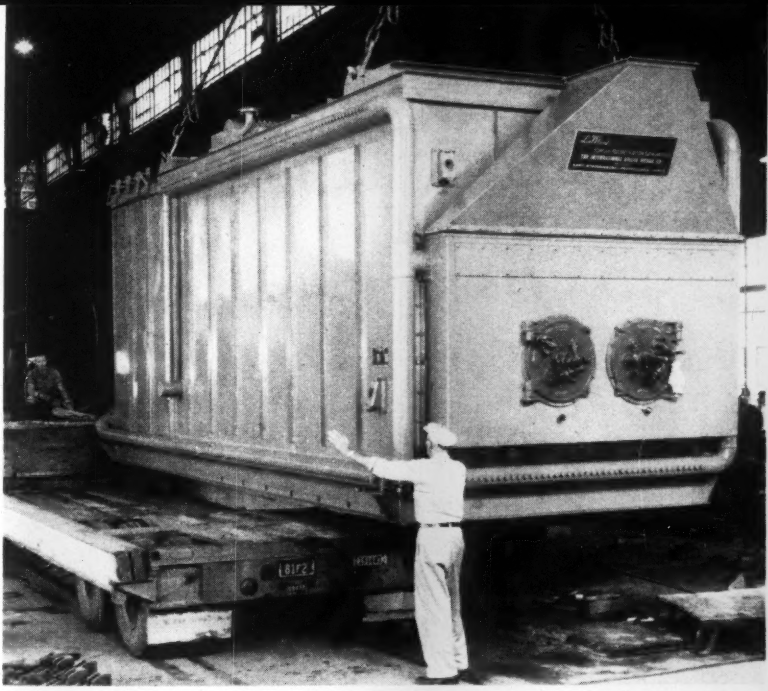
For purposes of this article, 250 F and under is considered "low temperature;" over 250 F and under 400 F, "medium temperature;" 400 F and over, "high temperature."

Preliminary design was made for a 125 psig steam heating system and a similar preliminary design was made for a medium temperature hot water (MTHW) heating system operating at 300 F. Careful cost analysis was made for each of these systems, including initial costs, operating costs, and maintenance costs. The 300 F MTHW heating system showed an initial saving of 18 percent over the steam system. Estimated maintenance and operating cost indicated an annual saving of approximately 21 percent with the 300 F MTHW system.

The preliminary design for the medium temperature hot water heating system proposed taking a temperature drop of 75 F through the system. We also proposed using cast iron pumps with water cooled bearings and cast iron valves. Schedule 40 seamless steel pipe meeting ASTM specification A106 grade A was to be used throughout. Weld fittings were proposed and connections to equipment were to be made through use of weld neck flanges. No screwed fittings were to be permitted.

Preliminary design was then made for a MTHW heating system operating at 350 F and another design for a high temperature hot water (HTHW) system operating at 400 F. The 350 F system proposed using the same material as the 300 F system. A temperature drop of 120 F was assumed. Due to the smaller quantity of water being handled and the ability to simplify the distribution system because of the higher temperature drop, an initial saving of $60,000 was indicated.

Several changes in material were proposed for the 400 F HTHW heating system, which was finally selected. Cast steel bodies are used for the valves and the pumps. Although the 400 F operating temperature will be maintained, the system was designed for 300 psig at 430 F. The permissible temperature drop through the system is 180 F.



ONE OF THREE packaged high temperature hot water boilers for Douglas DC-8 heating plant. Each of these boilers has a capacity of 36 million Btu per hr

Schedule 40 pipe still meets the code requirements for wall thickness. The distribution system in the 400 F system is the same as that for the 350 F system. Smaller pipes, valves, and pumps are used. Cost analysis indicated an additional saving of $35,000 in favor of the 400 F heating system. As the temperature drop increases, the operating cost due to pumping fewer gallons decreases; however it is assumed that the operating cost saving will be offset by the slight increase in maintenance due to the higher initial temperature. ≠

Photo on this page courtesy International Boiler Works Co.

Instrumentation, Welding Discussed at Safety Meet

. . . also tips for handling gases

AMONG the topics discussed at the recent 44th annual National Safety Congress held in Chicago were the contribution of industrial instrumentation to safety progress, hotter flames for welding, and safety tips for handling compressed gases.

"Industrial instrumentation and safety go hand in hand," said Donald W. Richmond, instrumentation engineer of the Monsanto Chemical Co. "The use of indicators, recorders, controllers, and transmitters for measurements such as temperature, pressure, flow, liquid level, and other analytical purposes is making rapid progress, particularly in the chemical industry. This is mainly due to production demands, but it is also bringing many safety advantages."

Welding of the future will be even hotter than it is right now, according to John J. Ferry, industrial hygienist, General Electric Co.

"The hottest known welding flame," he said, "has now been stepped up to 10,110 F, using such fuels as carbon subnitride-oxygen.

"It is safe to assume that new high temperature sources will be considered for welding as soon as they can be maintained and controlled properly," Mr. Ferry said.

Safety tips for the storage, handling, and use of compressed gases were given by R. M. Neary, safety engineer of the Union Carbide & Carbon Corp.:

1) The contents of a cylinder should always be identified by the written word on the label.

2) When moving cylinders, valves should be protected by caps or other means. Cylinders should never be dropped forcefully on any hard surface.

3) Cylinders in use or in storage should be kept away from arc welding operations. If necessary to locate a cylinder adjacent to a welding station, it should be electrically insulated from the structure, floor, and ground.

"These examples are by no means all the safe practices that should be followed when handling compressed gas cylinders," he said. ≠

1 CONTROLLED HUMIDITY ATMOSPHERE is maintained in large central curing room which holds 12 samples

2 RELATIVE HUMIDITY can be adjusted to any level and controlled within ± ½ percent

Study Vapor Transmission Rates

. . . through wall samples tested at new U. S. Naval Civil Engineering Research and Evaluation Laboratory to aid in design, operation, and construction of dehumidified warehouses

BY STUART GILES
Director
Heat and Sanitation Div.
U. S. Naval Civil Engineering
Research and Evaluation Laboratory

The Navy's Bureau of Yards and Docks is conducting an investigation into the problems of design, operation, and construction of dehumidified warehouses for the long term storage of military equipment. The U. S. Naval Civil Engineering Research and Evaluation Laboratory, working under this program, has developed a laboratory facility which will measure the vapor transmission rates of composite wall samples made from such materials as concrete block and brick. This facility was recently constructed and put into operation at the Port Hueneme, Calif. laboratory. A year of pilot plant operation was required to develop the design of this facility.

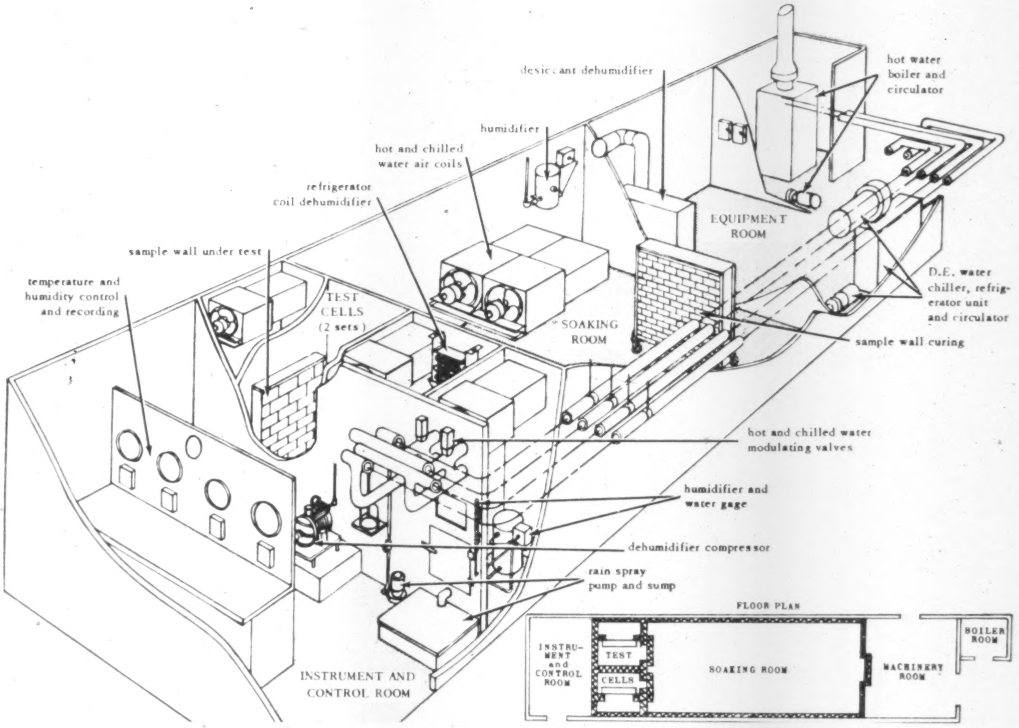
Vary Relative Humidity from 35 to 95 Percent

Laboratory tests showed that three to four months were required to cure and test a typical sample of masonry wall. Because of this, the laboratory was designed and constructed with a large central curing room which will hold up to 12 5 x 5 ft wall samples in a controlled humidity atmosphere. From this soaking room, the cured samples are moved into one of the two test cells. Here, the moisture passing through the wall sample is measured under controlled conditions of temperature and vapor pressure. The vapor transmission rate is calculated from the data obtained in terms of grains per hr per sq ft per in. mercury vapor pressure difference of wall. The relative humidity in the soaking room can be varied from 35 to 95 percent.

The laboratory was designed and developed by Mr. R. J. Zablodil and Mr. R. Hukill of the U. S. Naval Civil Engineering Research and Evaluation Laboratory and constructed by the Laboratory Shops Division.

The wall samples now under test include materials used in the construction of actual dehumidified warehouses at Gulfport and Davisville Construction Battalion Centers, as well as materials being considered for future construction. Tests of samples now in the laboratory will require approximately 12 months for completion.

The soaking room is 12 × 25 ft, and each test cell is 6 × 7 ft. The complete facility covers a floor area of approximately 21 × 65 ft.

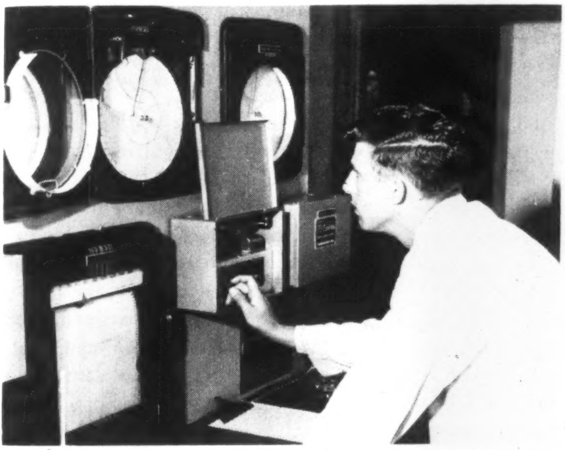

desiccant dehumidifier
hot water boiler and circulator
humidifier
hot and chilled water air coils
refrigerator coil dehumidifier
sample wall under test
temperature and humidity control and recording
TEST CELLS (2 sets)
EQUIPMENT ROOM
SOAKING ROOM
D.E. water chiller, refrigerator unit and circulator
sample wall curing
hot and chilled water modulating valves
humidifier and water gage
dehumidifier compressor
rain spray pump and sump
INSTRUMENT AND CONTROL ROOM
FLOOR PLAN
INSTRUMENT and CONTROL ROOM
TEST
CELLS
SOAKING ROOM
MACHINERY ROOM
BOILER ROOM

3 VAPOR TRANSMISSION LABORATORY is the only known facility which can be used to accurately measure vapor transmission rates of large wall samples at various levels of dry bulb temperature and relative humidity

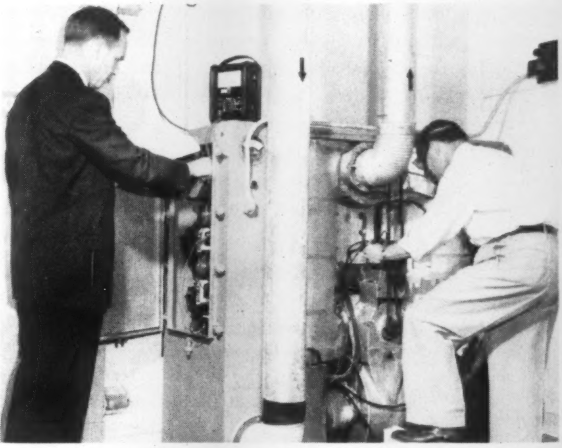
Hot, Chilled Water Coils Add, Remove Heat

This facility is the only known laboratory which can be used to accurately measure vapor transmission rates — permeability — of large wall samples at various levels of humidity. Relative humidity can be adjusted to any level and controlled within ± ½ percent. Water vapor is added to the various rooms by dampered evaporators and removed by refrigerated condenser coils or a desiccant dehumidifier. All critical temperatures are recorded and controlled by electronic equipment. Heat is added and removed by modulated hot and chilled water coils.

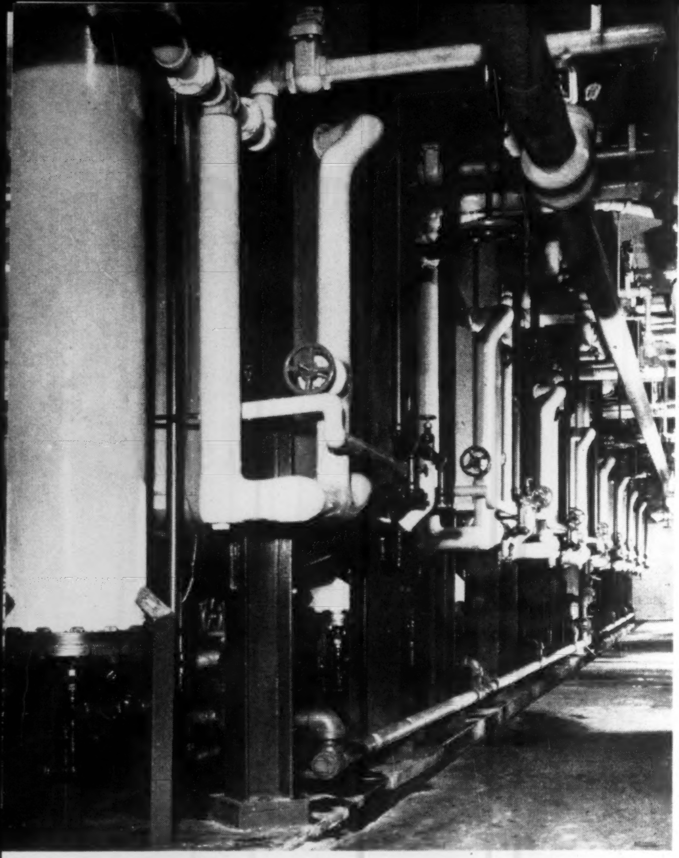
This laboratory is also being used to investigate the basic phenomena of vapor transmission and methods of control through the use of vapor barriers and variation of structural materials. ‡



4 CONTROL PANEL records and controls all critical dew point temperatures electronically



5 AIR CONDITIONING PLANT supplies air at desired temperature and humidity



Although each plant has individual requirements of piping, there are several fundamental ways to get more efficiency out of any piping system. In addition to the one discussed here, ten others have been presented in previous articles in this series. Others will be covered in future issues.

BY ROBERT J. PINSKE

How to Increase Efficiency Of Plant Piping Systems

11. How to Choose, Install, and Maintain Valves

THE SELECTION of piping equipment solely on a basis of pressure and temperature, without sufficient consideration for the special characteristics of the work to be done, was found a common practice in many of the industrial plants surveyed. A practice such as this always leads to false economy. At the same time, proper selection of the fewest possible types of valves, for similar services, offers excellent possibilities for reduction in piping maintenance costs.

The type of valve used, for example, is determined by the frequency of usage the valve receives, or the volume of flow desired. To apply a control valve properly, it is necessary to recognize its capabilities and limitations, which means to know what it can do, and how it does it. Such a valve may be described as a variable resistance in a fluid flow system. In any automatic control installation, it is as important a component of the system as the control instrument. The valve must be capable of performing in accordance with the dictates of the controller or the installation will be unsatisfactory.

Gate Best For Infrequent Use

The gate valve is best for services in which valves are infrequently operated and where the disc remains in a fully opened or closed position most of the time. The gate valve is definitely not recommended for throttling service because the velocity of flow against a partly opened disc may cause vibration and chattering, and will result in damage to the seating surfaces. Also, when a gate valve is throttled, the disc is subjected to severe wire drawing erosive effects.

The author is sales manager, heating and industrial division, Warren Barr Supply Co.

Previous articles by Mr. Pinske on industrial piping maintenance have been published in the November and December 1956 and January and February 1957 HPAC's.

Regulate Flow With Globe Valve

The globe valve is better suited for use where flow regulation service is desired, with the valve being frequently operated, or with its disc set in a partly opened or throttled position. The plug type disc globe valves are generally best for the most severe throttling services.

Another point that must be considered is the shorter disc travel in the globe valve, as compared to the longer disc travel in the gate valve. The shorter disc travel of the globe valve requires less time to operate. The disc and seat are quickly and conveniently reseated, or replaced, making them ideal for services that require frequent valve maintenance.

The angle type globe valve has the same operating characteristics as regular globe valves, and is used when making a 90 deg turn in a line, thereby reducing the number of connections and labor required to make up a connection. It also has less restriction to flow than the elbow and globe valve it displaces.

The sizing of valves is the next important factor. The minimum size which will handle the peak load will generally give the most economical operation. However, in handling liquids that must be pumped, the lines must be large enough to keep the pressure loss at a minimum, or the penalty will be continued excessive pumping costs.

The maintenance of valves can be reduced to an almost unbelievable low, merely by periodic inspection. The frequency of these inspections depends upon specific service conditions as stated above. It also depends on how frequently the valve is operated, whether every few minutes, once or twice a day, or once or twice a year. The more frequently the operation is performed, the more often the inspection should take place. If at any time, there is evidence of seepage, a new disc should be installed and the seat reground immediately, or else the slight seepage will develop into a leak with wire drawing of the seat, and the usefulness of the valve will be halted.

Another, and more drastic, effect of leakage is the accumulation of condensate within the valve, because if it is opened too quickly, the resulting water hammer can be so excessive that it may destroy not only the valve and piping but the operator's life as well.

Valve economy, an objective at all times, is all the more important now because of the increased cost of labor and valve replacement, which has paralleled the increase in all expenses of plant operation. The majority of valve failures can be prevented. To prevent failure and insure efficient operation, valves must be properly selected, correctly installed, and adequately inspected and maintained.

Perhaps most typical of the ills existing in the improvised piping of recent years is the misapplication of valves. Because shortages existed during, and for some time after World War II, it was understandably condoned when improper types of valves were installed. Their use, however, may be adding to costs stemming from avoidable maintenance and inefficiency. This cannot be justified now that valves are readily procurable in proper types for individual services.

When the service in which a valve is to be used requires special design and materials, it is poor economy to try and make an inexpensive valve do the job. The maintenance labor cost of a breakdown in a vital section of the plant and loss of production will far more than offset any initial saving.

How To Install Globe Valves

A very common occurrence in a number of industrial plants, especially the smaller plants, is the improper installation of the globe valve. Common, too, is the question whether the pressure should be above or below the disc. In some cases, it was found that plant engineers refused to install globe valves; instead they standardized on the gate valve because of improper understanding of the working functions of a globe valve.

The proper decision as to whether to install the globe valve with the pressure above or below the disc will be made if consideration is given to the danger and damage to equipment that would result if an interruption of flow took place because of valve failure. In a boilerfeed line, for example, if the disc of a globe valve became detached from the stem, pressure on the top of the disc might cause it to seat and stop the flow. Here, pressure below the disc is advisable. In the supply line to steam driven pumps, valve failure might permit pressure from below the disc to push it wide open and cause the pump to run wild. The pressure above the disc is recommended here or in a steam line to heater units, to steam processing equipment, etc.

Generally, however, installing globe valves with the pressure above the disc, especially in hot lines, will help to insure tight seating, and such practice is to be preferred unless conditions similar to those discussed here must be considered. Therefore, it is important to inspect all globe valve connections where service conditions would dictate pressure above or below the disc.

Three Main Groups of Valves

Most pipe line valves fall into one of three large groups: stop valves; intermittently acting valves; and throttling, or regulating valves.

Stop valves, of which the common gate and globe valves are examples, are usually hand operated, and remain either open or closed for long periods. Except for needle valves, when used as hand expansion valves in refrigeration service, regulating valves are usually automatic in operation. The intermittently operating valve is a stop valve which is either completely open or completely closed, the opening and closing at short intervals being regulated by an automatic device. The bucket operated steam trap is an outstanding type of this third group of valves.

The functions of valves are mainly as follows:

Gate valves, quick opening valves, and plug valves are used to halt the flow of fluids in a pipe line.

Globe and angle valves, needle valves, "Y" valves, diaphragm valves, butterfly valves, and blast gates are used to throttle or control the quantity of flow.

Swing check, lift check, ball check, and nonreturn valves are used to control the direction of flow.

Clean Before Installation

Before installing pipe line valves, all dirt, scale, and foreign matter should be carefully blown out of the pipe and valves by either air or steam. Equipment such as boilers, pressure vessels, and tanks should also be freed of dirt or scale before valves are operated.

If periodic cleaning or overhauling of automatic devices, valves, or equipment is caused by the presence or accumulation of dirt or foreign matter in piping, the installation of a sediment separator may reduce maintenance costs. After cleaning and during installation, valves should always be tightly shut to prevent the entrance of dirt.

During erection, pipe lines must be properly and adequately supported to prevent sagging and throwing strain on valve bodies with resultant distortion.

Wherever possible, all valves should be installed in the vertical position with the valve stem on top. Some valves have flow arrows cast in their bodies. Valves must be installed accordingly. Check valves in vertical lines can only function if the flow is upward.

Tighten All Bolts Uniformly

After installation is completed, all lines should be flushed out with water or steam, and all bolts and nuts on flange connections should be carefully tightened to eliminate leaks. Bolts should be pulled up on diametrically opposite positions until all are uniformly tight.

If the valve does not close tightly, a wrench or extra leverage should never be applied to the wheel. The valve should be dismantled and seating surfaces inspected to find the source of trouble. Refacing of valve seats may be a sufficient remedy. To prevent distortion, suitable seat wrenches must always be used to remove valve seat rings. Valves on pressure lines should be closed slowly to prevent the strain on lines and fittings caused by water hammer.

Why Some Valves Keep Leaking

For economic reasons, leaking valves should be inspected for evidence of other than normal wear and repaired or replaced as soon as possible. When the valves keep on leaking after the ordinary corrective moves have been made, the trouble is usually one of the following factors:

- Expansion and contraction strains in the pipe line not properly met by anchors and supports.
- Excessive vibration.
- Corrosive action.
- Dirt and foreign matter.

The expansion and contraction strains when transmitted directly to the valves will usually distort the valve bodies. The dirt and corrosion will cause valve leakage by releasing the stem threads, or will cause crystallization of the metal, resulting in serious damage to the working parts.

The correction of such conditions may often be achieved by the rearrangement of the anchors and supports, or by making slight changes in the line. ‡

Other articles by the author on piping maintenance will be published in future issues of HPAC.

Glass Block Wall Cuts Fuel Bill 25 Percent

. . . and reduces infiltration of dirt

DENVER Buick
DENVER BUICK
SERVICE BUICK PARTS

GLASS BLOCKS, installed more than five years ago in the service shops of a Denver garage — primarily to replace rusted window sash and to give better lighting in the work area — have reduced the annual fuel bill 25 percent, according to the Pittsburgh Corning Corp.

Located high in the Rockies, where winter weather can be prolonged and most severe, the Denver Buick Co. in 1951 ripped out its weather worn steel sash and flat glass windows, replacing them with more than 2300 8 in. glass block panels.

Savings in heating costs, according to Harold Cohan, president of the company, were noticed immediately. Fuel bills for the two story brick structure, heated by radiators and unit heaters from a gas fired boiler, dropped from $1200 to $900 a month. No other changes were made in the structure or heating system.

Painting and puttying of sash has been eliminated and washing has been reduced to twice a year.

Five years' experience with this installation has shown that the dirt and dust infiltration from the street has been cut to a minimum.

The blocks are set up in panels, 4½ × 16 ft, with two clear glass ventilators, 3½ by 2 ft. set into each panel. Set in mortar, the blocks become an integral part of the building allowing no air or moisture leakage. ‡

Sam Lewis' Page

How Facts Help City Control Smoke

Design and operating data of a heating plant, location and purpose of a building and whether it is new or existing, and other factors all aid the building department in approving or rejecting a particular heating plant.

THE CITY of Columbus, Ohio, has an especially well functioning smoke control department which has issued some interesting suggestions by Charles Bopst, chief building inspector, entitled *More Money in the Contractor's Pocket.*

Mr. Bopst cites that losses have been incurred by contractors in making changes in burner and boiler plants. Many of these losses could have been avoided had the equipment been designed correctly.

Explains Permit Application

An explanation of an application for a permit is presented, with logical and sometimes humorous comments. The building department must know where the building is and whether it is new or existing. It must be told the purpose of the building. Conditions may be different for a manufacturing plant from those for a hospital or for a church, and so the department must be told.

Apparently, Columbus applications have not always stated whether the plant involves a boiler, a furnace, an oil burner, a gas burner, or an incinerator.

The department is interested in knowing how the heat from the fire is expected to be delivered to the rooms. This delivery of the heat might involve help from fans for air, pumps for water, and a pump for inducing subatmospheric pressure for steam and condensate.

The rated capacity of the fuel burner must be stated in volume or in weight of fuel. The dimensions of the combustion chamber and the proprietary name of the manufacturer of the fuel burning device must be stated. Obviously, in order to accept a scheme for control of smoke the department must know whether manual firing or firing by a stoker or by a burner for oil or gas is contemplated.

Interest is vital as to the size and height and character of the chimney and to its relation to adjacent buildings.

One appreciates also the concern on the part of the department as to the authority under whose rules heat demand from the combustion was calculated.

The rules of the Mechanical (Heating, Piping, and Air Conditioning) Contractors Association of America or those of the American Society of Heating and Air-Conditioning Engineers are cited as authoritative.

Why City May Reject Plants

Here are some of the interesting reasons why the city may not approve plants:

1) No smoke indicator, or one that cannot be seen from the fireman's position.

2) No specific intake for combustion air.

3) Barometric damper in the breeching not double acting.

4) Direct flame impingement against water cooled surface.

5) Flashback through firebox shutters and doors following ignition.

6) Too low CO_2 content or too high CO content, as shown by analysis of combustion.

Gives Numerous Safety Rules

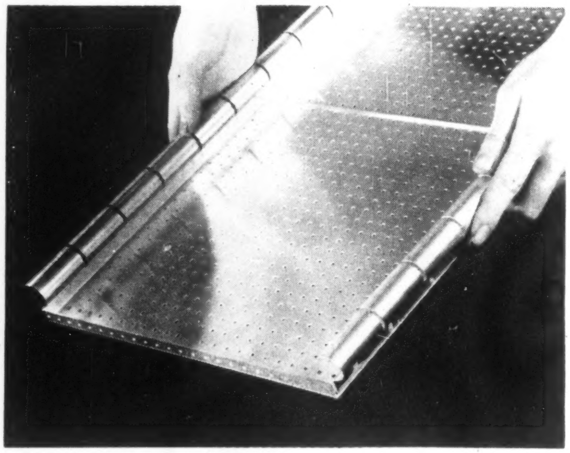
There are numerous safety stipulations concerning type, size, and location of fuel gas connections, especially as to pressure regulators and venting of the gas operated control valves.

Incinerators of chimney fed type are limited to single family residences. This rule seems logical to any one who has been compelled to remove chimney fed incinerators from 25 story apartment buildings.

Suggests Full Size Breeching

Another safety suggestion is that any horizontal common breeching be full size. When several forced draft boilers such as the Scotch marine type are served by a common breeching, trouble has been encountered from forcing the product of combustion from one boiler into another boiler. Better service usually is rendered in multiple boiler installations, if the horizontal breeching is full size and not tapered to smaller cross sections as each boiler is passed. ‡

SAMUEL R. LEWIS, *consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems.*



Aluminum Piping + Snap-on-Panels

Aluminum is used extensively throughout the heating, cooling, and air handling systems: in finned water chiller and condenser tubes, and in the piping, cooling tower, heat exchangers, ceiling channel framework, pans, and tubing, as well as in all ductwork, plenums, grilles, and diffusers, and even in pneumatic control tubing and control valves. A previous article on the aluminum piping applications in this building was published in the November 1953 HPAC.

By NEIL B. WALSH and BARTLETT R. SMALL
Mechanical Engineers
Aluminum Co. of America

ALCOA BUILDING, first aluminum skyscraper in the U.S., stands 30 stories high and faces Mellon park in Pittsburgh

WHEN the Alcoa building, the first aluminum skyscraper in the U.S., was completed in 1952, one of the most unique heating and cooling and air handling systems was put into operation. Now, after four years' experience with the aluminum ceiling system which heats, cools, and ventilates the building, here is the report of the results experienced.

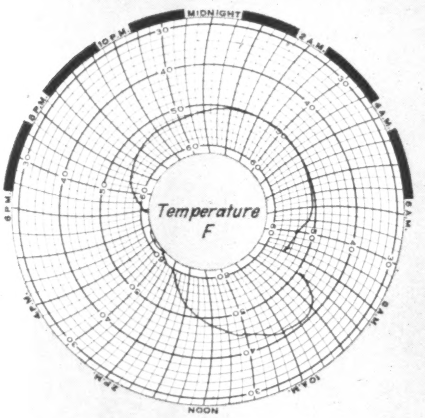
Save 15,000 Sq Ft of Floor Area

Several factors governed the unusual design details of the building's heating and cooling system:

1) *Efficiency.* Alcoa was determined to have for its building modern and effective equipment.

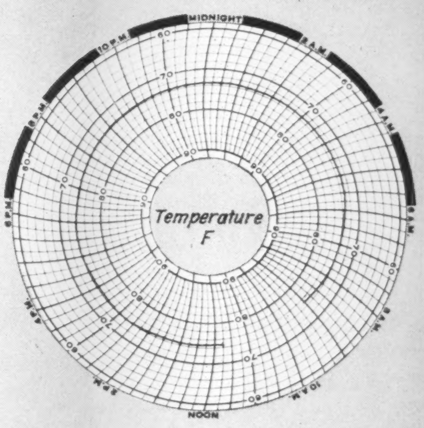
2) *All Aluminum Units.* While aluminum had never been so extensively employed, the company was convinced that the metal was ideally suited for both the water and air systems.

3) *Space Saving.* One of the prime considerations in the overall planning of the building was, through the use of the lightweight metal, to save space and increase usable floor area. By using aluminum radiant heating and cooling panels in the ceiling, there resulted a gain of about 15,000 sq ft of rentable floor area, equivalent to $1\frac{1}{2}$ floors of the building.



OUTSIDE temperature, measured on the roof of the building, ranged from 41 F to 68 F in one 24 hr period

INSIDE temperature, in a typical office on the same day, remained a constant 74 F, showing the ceiling panel system's ability to respond to quick changes in outdoor temperatures



= Constant Comfort in Alcoa Offices

Aluminum Used in Primary Water System

Of principal interest in the primary system is the application of aluminum in several deviations from conventional practices. Particularly noteworthy is the extensive use of the metal in finned aluminum water chiller and condenser tubes — tubes which have an aluminum clad bore — and in the control system. Also, a large amount of aluminum is employed in the rooftop cooling tower and in much of the system's piping.

The primary water system of the heating and cooling units is of conventional design, except, of course, for the aluminum applications. The two refrigeration compressors are 625 tons each. A conventional reverse return piping system is used in the primary circuit to alleviate the problem of one floor siphoning off the hot or cold water being directed to another level.

Control System and Tubing Are of Aluminum

In the secondary system, too, engineers used aluminum as a corrosion resistant metal. For the first time, an all aluminum control system and control tubing were installed. One hundred sixteen hot water and cold water heat exchangers employ aluminum tube bundles and shells. Also, all the piping from the heat exchangers to the ceiling grids, and the entire grid system itself are of aluminum. Each floor is served by a common expansion tank.

For control purposes, each of the building's floors has been divided into four zones: east, west, south, and interior. An "interior" zone is necessitated by the lack of solar load in the inside rooms.

Control of these zones depends on the functioning and coordination of two way and three way valves. These valves — one set for each zone — respond automatically to the thermostats in the respective areas. The thermostats, set at 74 to 76 F, shut off one or the other of the valves, bringing into the ceiling grids hot or cold water as demanded. Accompanying the thermostat and set of valves for each zone is a secondary exchanger and a secondary pump. Thus, each zone is a selfcontained unit served directly by the secondary pump at the secondary heat exchanger, and indirectly by the chilled water and hot water pumps of the primary systems.

System Adapts Quickly to Outside Changes

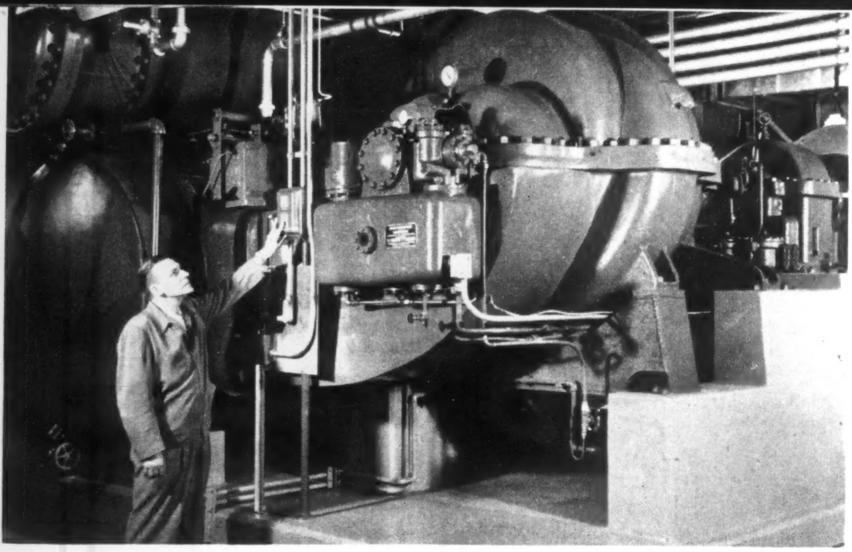
The heating and cooling systems have functioned very satisfactorily. The zoning, however, has required minor adjustments. Unbalance of temperatures was solved by adjustments of manual balancing valves at the coil grids and by setting individual zone thermostats to satisfy the occupants.

One of the most important advantages offered by the ceiling heating and cooling system has been the saving of time spent in servicing complaints from the tenants. As in all new buildings, the first few months were devoted to eradicating "bugs" from the heating and cooling system. After the system began to work fully, however, comfort complaints from the 1600 occupants have dwindled to an average of only two per day. This saving of servicing time has been especially attributed to the ability of the system to adapt itself to quick changes in outside temperatures.

Grid System Serves Two Functions

The grid system has two fuctions: as a unit to circulate hot and cold water; and as a system to directly support ceiling pans. Welded to each grid section is an aluminum channel framework which supports the grid. This frame-

REFRIGERATION PLANT consists of two 625 ton compressors, water chillers, and condensers in the basement, served by a rooftop cooling tower



work, in turn, is supported by hangars from the cellular steel floor above, and is leveled by turnbuckles. Most grid sections are 6 × 12 ft in size.

From secondary pumps hot or cold water is delivered to the ceiling grids through aluminum tubing. A grid consists of ½ in. aluminum pipe on 12 in. centers, welded to the supply and return headers. The perforated aluminum ceiling pans are clipped to these pipes. A flow control valve is inserted in the return from each grid.

An ordinary mill finish on the top of the 0.040 in. gage 12 × 24 in. pans resists upward radiation. Two coats of paint on the underside increase downward radiation.

Ceiling Panels Have Numerous Advantages

Aluminum ceiling panels have been found to offer many advantages. The high thermal conductivity of the metal permits wide spacing of the water carrying tubes, and as a result the temperature on the effective face of the panel closely approaches that of the water in the tube. This has made panel cooling practicable because the temperature of the chilled water can be above the dew point of the ambient air and still provide effective cooling. There has not been one instance of condensation forming on the face of the aluminum ceiling pans. The aluminum panels also respond rapidly to quick changes in water temperature.

Acoustical treatment was accomplished with no adverse effect on the thermal performance by perforating the panels and overlaying them with glass wool blankets in a manner common to metal acoustic ceilings. Recessed light troffers and diffusers are used in conjunction with the panel ceiling.

Air Handling System Almost Entirely Aluminum

The air handling system employed in the Alcoa building is almost entirely made of aluminum. Light metal components include all ductwork, plenums, grilles, and diffusers.

Also in the primary supply systems are carbon cell reactivating units for all return air, ranking among the largest to be installed in an office building. Primary air systems are in the basement, and on the 14th and 31st floors.

Mix Return Air and Outside Air 50-50

Entering the building through dampers, the outside air is introduced through electrostatic filters, and preheat coils. The return air is channeled through electrostatic filters, and carbon cells.

Further conditioning of the air includes passage of the mixed air through a spray coil dehumidifier and reheat coils. Then the air is forced into a duct shaft for distribution to the local floor secondary systems.

Secondary air fans are on each floor of the 30 story building. The primary air supply is introduced into these secondary fans from the duct shaft. Here, the primary supply is mixed in a 50-50 ratio with air returning directly from the floor serviced by the fan unit. Thus, the air actually circulated on each floor is composed of 25 percent outside air, 25 percent reconditioned primary return air, and 50 percent floor return air. The air enters the room through ceiling and soffit diffusers. Return air grilles in each office admit air to the ceiling plenums and to a short return air duct system.

Supply Air Temperature Differential Is 8 F

The secondary air is delivered to offices at a constant 68 F temperature year 'round. Load changes are met entirely by automatically changing water temperatures in the ceiling grids. Thus, with a 76 F room temperature, only an 8 F supply air temperature differential results. This is achieved with 40-50 percent less air than in conventional systems.

The Law and Your Profits

BY WILLIAM HURD HILLYER

Oral Agreement Proves Costly

. . . for contractor who makes installation according to job modifications verbally understood but not put in writing. Court supports defendant client in withholding final payment and claiming damages on grounds of "improper work."

FRANCIS BACON, that greatest of lawyer-philosophers, has said that "writing maketh an exact man." A wholly written contract keeps all parties from change of mind and faults of memory. In the following case the troubles were heightened by the introduction of "judgment." Anything left to one's judgment is often open to difference of opinion and the calling of experts for inspection.

Part of Agreement Verbal

Trustees of the Reliable Realty Trust retained Wright Presha Co., heating, piping, and air conditioning contractors, to install a steam boiler on the trustees' premises. These consisted of two old buildings with two cellars, in each of which was a boiler. The new boiler would replace the two old boilers. It was agreed that the heating contractors were "to utilize the existing pipes, returns, and radiators, wherever possible."

Part of the agreement was verbal, part in writing. The letter recited that "the system was to be zoned," so that there would be one zone for the first and second floor levels, and another zone for the third floor.

After the boiler was installed, occupants of the buildings heard a "knocking and banging" in the pipes. The trustees brought this to Wright Presha's attention. They found the zoning entirely different from that called for in the agreement.

Expert Finds Job Faulty

An expert later testified that the work was improperly done. The contract price was $2140, of which $1900 was paid, leaving a $240 balance. This the trustees were willing to pay, if the heating contractor would correct the alleged defects.

Instead of so doing, the contractor sued the trustees for the balance due. The trustees on their part brought a cross action against the contractor, to recover on breach of contract.

According to Wright Presha, he was told to do a good job and use his judgment when necessary. The trustees swore otherwise. When the contractor came forward with evidence to the effect that a change in the zones was agreed to, the trustees denied any such understanding.

Judge Recounts Deficiencies

The district court, a woman presiding, found for the trustees in the sum of $725 as to both actions. Her findings were as follows:

Under agreement between parties, the first and second floors were to be joined in one zone; the third floor was to constitute another. That floor, however,, was not zoned separately. Failure to do this was a substantial deviation from the terms of the agreement.

The boiler was incorrectly installed and there were "various other unworkmanlike matters connected with the job — including the size and pitch of some of the pipes, the size of the return lines, the placement of valves, and the omission of a tee for an elbow."

There was an "excessive amount of thumping and banging in the pipes and radiators," which caused much disturbance among the trustee's tenants. The trustees, on many occasions, sought to have the contractor remedy these defects, without success.

Denies Contractor's Requests

The district court judge denied all of Wright Presha's requests for rulings and refused a report to the appellate division. The contractor therefore appealed to the supreme court.

In affirming the dismissal of reports to the appellate division for Wright Presha's benefit, the higher tribunal held there was no error on the trial court's part. In addition to arguing that the amount of damages awarded against Wright Presha on the cross-action was improper, the heating contractor had requested the following rulings:

"1) The evidence warrants a finding for the contractor on an oral contract.

"2) The evidence is insufficient to warrant a finding for the trustees.

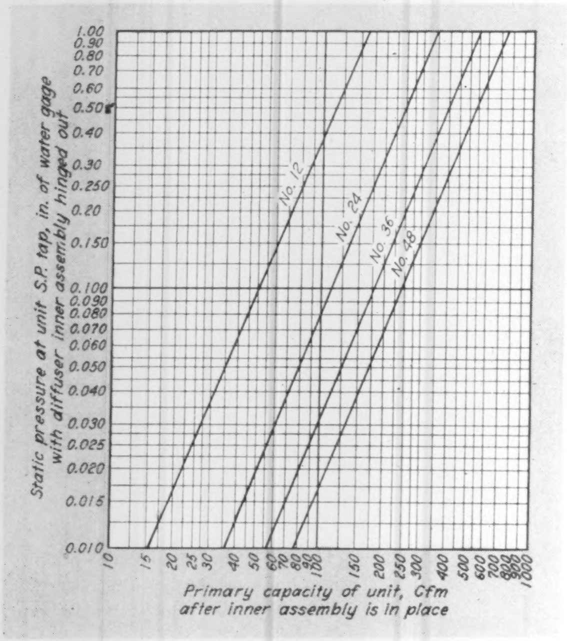
"3) The evidence is sufficient to warrant a finding for the contractor."

The trial judge denied all these requests and the supreme court upheld that denial.

Wright Presha therefore faced a sizable judgment on more or less technical grounds, largely as a result of improvidently mixing oral with written agreements. ‡

WILLIAM HURD HILLYER, *author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. He has an extensive practical legal and financial background.*

This series presents actual cases. Naturally, laws vary in different states. All names are fictitious.



1 A TYPICAL CALIBRATION CURVE for a straightline or under-the-window unit is used for determining the capacity of a unit. For any given pressure drop, a corresponding capacity of air is shown on the graph

2 BALANCING OPERATION on an under-the-window unit includes adjustment of the valve with a slotted screw driver. The draft gage is connected to the unit static pressure tap

How to Balance High Velocity Air Conditioning Systems

System inspection and the use of proper balancing procedures can save time and avoid snags in operating the system. The author outlines a step by step procedure based upon experience.

BY WILLIAM J. WAELDNER
Anemostat Corp. of America

The art of balancing an air conditioning system involves a substantial amount of trial and error. Past experience, however, with high velocity systems and with "bugs" that sometimes develop when the system is put into operation indicate that some science can be brought into the art.

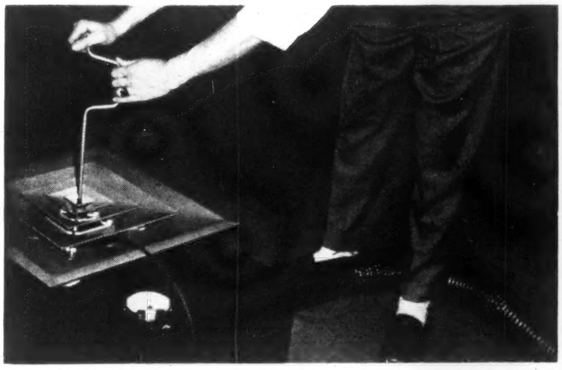
This article outlines the steps that may be followed in balancing a high velocity system. In addition, some operating difficulties that have occurred in a few actual installations are analyzed to help prevent similar difficulties in future systems.

How to Simplify Balancing

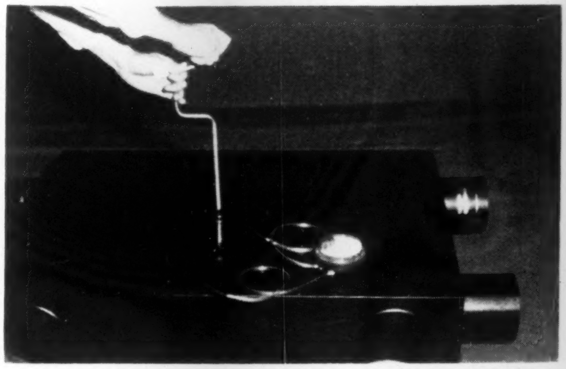
It is impossible, of course, to give precise rules for balancing high velocity systems that will apply in all cases. Generalized recommendations based upon experience can be made, but due to the great number of variables that can come up on any job, a certain amount of resourcefulness must be used in coping with problems unique to the installation.

The following rules should be observed on all installations, in my opinion. If these basic steps are followed, some time can be saved in balancing the system.

1) The system must be complete. It is useless to attempt to balance the system before the installation has been fully completed. All the high velocity units should be installed and all the diffusers should also be installed. In addition, all the controls must be in operating order.



3 BALANCING a ceiling diffuser, test operator adjusts valve at center of diffuser. The draft gage is connected to the static pressure tap by rubber hose



4 TWO UNIT STATIC PRESSURE CONNECTIONS are needed to measure the pressure differential across units of the octopus type, shown here, and the end-of-box type

2) The entire system and specifications should be checked by the engineer in charge. The duct layout should be reviewed for any special conditions or problems peculiar to the installation. The capacity of all units should be determined, as well as the total fan capacity.

Special balancing requirements, such as those caused by minimum flow limitations for manual or automatic volume controlled units, should be noted.

3) Basic balancing tools should be available. These are: (1) draft gage and tubing; (2) capacity calibration curves, or *K* factors, for each type of unit in the system; (3) screw driver or speed wrench; (4) for certain types of units, an accurately calibrated meter for measuring air velocity.

Before actual balancing begins, the valves of all high velocity units should be adjusted to a fixed position at a media of the capacity static pressure range for the particular units involved. This is usually done before they are shipped from the manufacturer's plant. Thus, when installed on a job, the capacity handled by all the units will approximate the final balance total capacity, providing the fan and other system components are properly adjusted.

Begin with Three Main Steps

With the above preliminaries taken care of, the actual balancing can begin. The steps listed below can be used as a basic guide to the balancing procedure, although, as noted earlier, modifications may be called for in an individual case.

1) Under normal circumstances the total capacity should be first checked in a convenient spot at the central station equipment. The total capacity measured at this time should approximate the design capacity. If not, the inlet vane damper should be adjusted to change the capacity to the correct value. If there is no inlet damper, the fan discharge damper may be adjusted, or the fan drive can be changed to bring the capacity to the correct value. However, it is suggested that inlet vane or vortex dampers be specified on all high velocity systems. It is generally easier to adjust this type of damper, and such adjustment, therefore, generally results in a quicker balancing job.

2) After the total capacity has been adjusted to the design value, the next step is to adjust a typical unit close to the fan and one near the end of the duct run. Assuming typical units are selected, it will be necessary to open the valve on the unit at the end of the duct run and partially close the valve on the unit near the fan.

3) On a large system with several long parallel branches, check units at the extremes of each branch before adjusting all the units on any particular branch. After the units at the ends of the runs are adjusted to the correct capacity, the remaining units are balanced, starting close to the fan and working toward the end of the system. In this way, it will not be necessary to rebalance the units after the first adjustment. However, it is advisable to make spot checks along the system after it is completely balanced.

How to Balance Single Ducts

Single duct systems with automatic volume control are balanced in basically the same manner.

Before the total system capacity is checked at the central station, the static pressure control dampers should be set in a fixed position and the pneumatic damper operators in the high velocity units positioned to open the unit valves. This can easily be done either by bleeding the pneumatic control line to all the room thermostats or by adjusting the individual room thermostats so that the valves will open fully. The system is then balanced as outlined for a single duct manual control system.

After the balancing has been completed, the static pressure controls must be adjusted to maintain a constant duct pressure regardless of the total air capacity handled. This may consist of a vortex damper with the static pressure sensing element midway down the duct run. On large systems with several main branches, each branch may have its own static pressure damper. The duct static pressure is then measured at the sensing element of each respective damper, and the damper is calibrated to maintain this pressure. With the system balanced and the static pressure dampers adjusted, the individual room thermostats are returned to the control position.

How to Balance Dual Ducts

Dual duct systems are balanced in practically the same manner as the single manual and single automatic systems, with a few additional steps to include the second duct. In the steps below, it is assumed that the cold duct can handle the total volume of supply air and the hot duct can handle any probable percent of the total — say between 50 and 100 percent as the particular design may require.

1) All the high pressure unit dampers should be opened to the cold duct. Since the duct static pressure drop is greatest when the maximum air capacity is being handled, balancing must be done with full flow through the cold duct to satisfy this condition.

2) The automatic volume or static pressure control must be disconnected, since its calibration point is indeterminate until after the system is balanced. The volume or pressure dampers should be normally positioned to provide the correct system capacity. My past experience with the volume-static pressure relationship of dual duct systems indicates that a volume type control installed at a common point in the system provides better control than a separate static pressure control in each duct.

3) After the total volume is adjusted, balancing proceeds as in the single duct manual control system.

4) With the system balanced on the cold duct, the automatic system controls should be adjusted or calibrated to maintain the respective conditions established during the balancing operation. In the case of static pressure controls, the dampers on the hot ducts may be calibrated to the same pressure as the cold duct. When the hot duct size is equal to the cold duct, it is preferable that the actual duct static pressure required be measured after all the attenuator diffuser unit valves are moved to open the hot duct. In case the hot duct is smaller than the cold, check whether the hot and cold ducts were designed on the basis of equal pressures and whether the respective control points are based on equal static pressure.

5) Next, move the attenuator-diffuser unit valves to the hot position. If the hot and cold ducts were equally sized, all the valves should be changed over. When the hot duct is sized for a given percentage of the cold duct, a like percentage of the dampers should be opened. To open more hot valves will upset the volume balance of the system as well as exceed the probability limitations of the system design.

6) With the valves moved to the hot position, it is well to check the capacity through the unit. There have been cases in which the hot ducts were not connected to the boxes, or foreign material had fallen into the duct, thereby limiting the quantity of air to the unit.

The amount of air flow through the hot duct for any unit will be the same as through the cold duct only if the static pressure at the unit inlet is equal for both ducts. The branch runouts to the units are sometimes different for each inlet, and therefore the capacities will differ by a small amount, proportional to the difference in the square root of their pressure drop.

How to Apply Pressure Balance

The term "pressure balance" was coined to cover the method employed in determining the air capacity handled by each unit while adjusting the pressure reducing valve to the design capacity. The capacity is determined by measuring the pressure drop across a fixed air path within the box, or the diffuser. For any given pressure drop across the unit, a corresponding particular capacity of air is handled by the unit. This ratio of pressure vs capacity is generally given on the capacity calibration curves furnished by the manufacturer.

A typical calibration curve is shown in Fig. 1. This calibration curve is for a straightline or under-the-window unit. It will be noted that the primary air capacity is shown as the abscissa of the graph and the unit static pressure as its ordinate. The term "unit static pressure" is used so that it will not be confused with "minimum duct static pressure." A separate line is shown on this chart for the 12 in., 24 in., 36 in. and 48 in. diffusers.

The balancing operation on an under-the-window unit is shown in Fig. 2. The draft gage is connected to the unit static pressure tap, and the slotted screw driver fitting, accessible through the jet plate of the the valve is adjusted by means of the under-the-window diffuser.

On the ceiling diffuser boxes, the static pressure tap is accessible through the diffuser in the form of a length of synthetic rubber tube, as shown in Fig. 3. The valve adjustment is at the center of the diffuser. For close coupled installations, it is possible to adjust the valve without removing the diffuser inner assembly. If an extension neck is used between the box and the diffuser, the diffuser inner assembly must be removed to gain access to the slotted screw driver fitting used to adjust the valve. On large jobs it is possible to allow for the resistance of the diffuser inner assembly when adjusting the valve for the proper capacity. A comparison of the data of several boxes with and without the diffuser will indicate the difference in unit static pressure to be allowed.

On both the octopus and end-of-box type units, shown in Fig. 4, it is necessary to use two unit static pressure connections to properly measure the differential pressure across the unit. This second tap is necessary to eliminate the effect of the resistance of the extension ducts which vary with each particular installation. ⌗

Another article by the author, to be published in a future issue of HPAC, will tell how operating snags were corrected in three installations.

Tear out along this line

Flow Chart Speeds Design of Low Pressure Gas Piping

Pipe sizing for low pressure gas systems can be simplified, with a great saving of time and work by the use of the flow chart given here. Developed by the author, the chart is based on the Spitzglass formula for rate of flow in cubic feet of gas per hour. Another chart, for high pressure gas, was published as the Data Sheet in the February HPAC.

BY WILLIAM J. WHATLEY
Mechanical Engineer
Patchen and Zimmerman
Consulting Engineers

THE LOW pressure gas flow chart on the following page is based on the Spitzglass formula for rate of flow in cubic feet of gas per hour:

$$Q = 3550K \times \sqrt{h/SL} \quad \ldots\ldots\ldots\ldots [1]$$

where: Q = rate of flow, cfh; h = pressure drop, in. of water gage; S = specific gravity, with air = 1.0 lb per cu ft; L = length of pipe, ft.

For example, for pressure drops of 10 in. WG, 1.0 in. WG, and 0.1 in. WG per 100 ft, respectively, the expression $\sqrt{h/SL}$ has the following values:

$$10\sqrt{(0.6 \times 100)} = 0.408 \quad \ldots\ldots\ldots\ldots [2]$$

$$1\sqrt{(0.6 \times 100)} = 0.129 \quad \ldots\ldots\ldots\ldots [3]$$

$$0.1\sqrt{(0.6 \times 100)} = 0.0408 \quad \ldots\ldots\ldots\ldots [4]$$

Tabulated below are the rates of flow of low pressure gas for various pipe sizes at a pressure drop of 1 in. WG per 100 ft of pipe:

Pipe diam, in.	3550K	× $\sqrt{h/SL}$	=	Flow rate, cfh
½	416	× .129	=	53.6
¾	960			123.8
1	1890			243.8
1¼	4160			536.6
1½	8450			1090.0
2	13,070			1686.0
2½	21,380			2758.0
3	38,930			5022.0
3½	x			
4	81,500			10,513.5
5	x			
6	241,800			31,192.2
8	512,500			66,112.5
10	886,500			114,358.5
12	1,280,000			164,920.0

How to Determine Pipe Diameter

Determine line size to handle 3000 cfh of gas at initial pressure of 8 in. WG, with pressure drop not to exceed 2 in. WG in a given run of 500 ft. Proceed as follows:

Enter chart at Q at 3000 cfh and proceed to 3 in. pipe intersection. This shows pressure drop of 0.35 in. WG per 100 ft of pipe. Total pressure drop is: 5.00 × 0.35 = 1.75 in. WG

Final pressure is:

$$P_1 - 1.75 = P_2 \quad \ldots\ldots\ldots\ldots [5]$$

$$8 - 1.75 = 6.25 \text{ in. WG} \quad \ldots\ldots\ldots\ldots [6]$$

How to Determine Pressure Drop

Determine pressure drop encountered in handling 3000 cfh of gas at an initial pressure of 8 in. WG through a 2½ in. pipe, over a run of 500 ft. Proceed as follows:

Enter chart at Q at 3000 cfh and proceed to 2½ in. pipe intersection. This indicates a pressure drop of 1.14 in. WG per 100 ft of run.

Total pressure drop is:

$$5.00 \times 1.14 = 5.70 \quad \ldots\ldots\ldots\ldots [7]$$

Final pressure is:

$$P_1 - 5.70 = P_2 \quad \ldots\ldots\ldots\ldots [8]$$

$$8 - 5.70 = 2.30 \text{ in. WG} \quad \ldots\ldots\ldots\ldots [9]$$

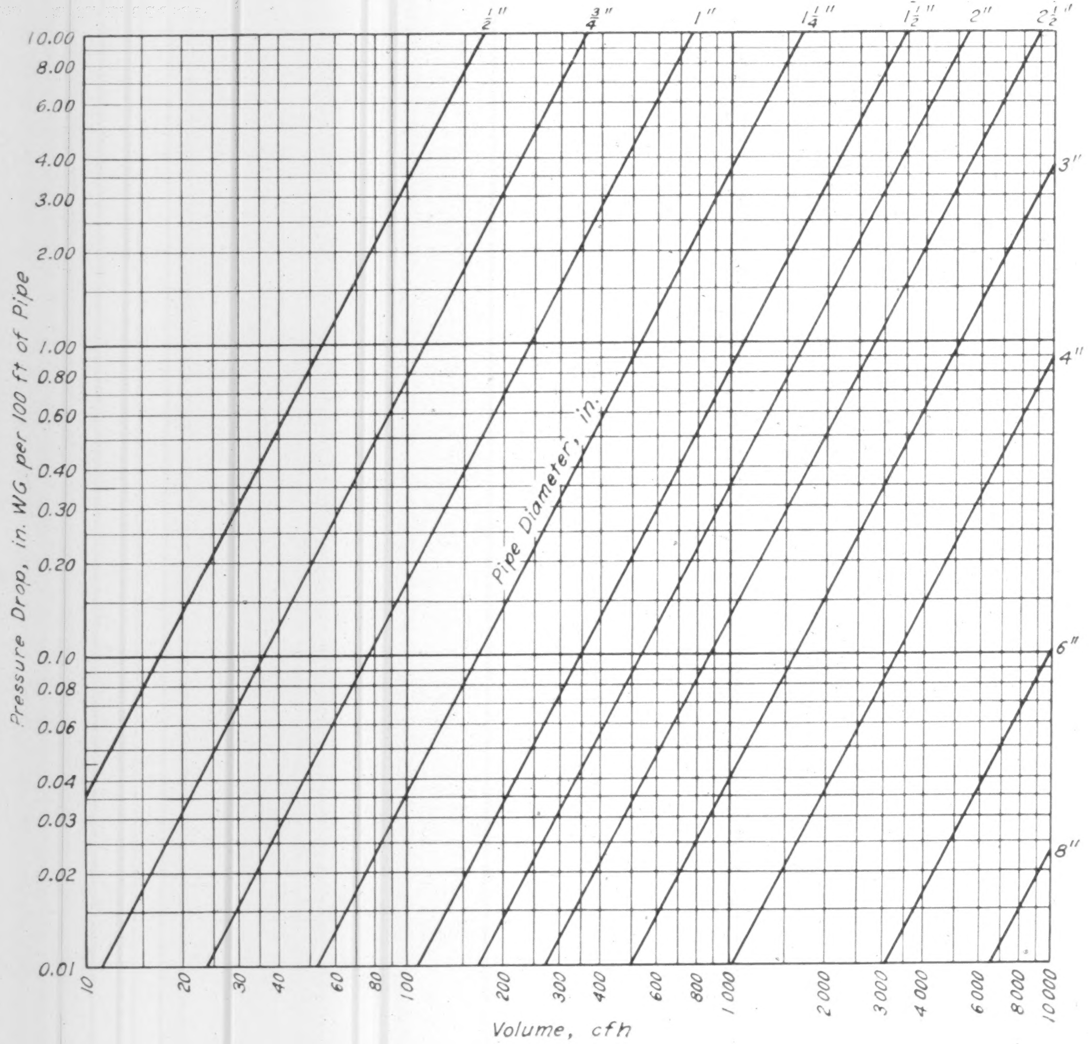
How to Determine Maximum Rate of Flow

Determine maximum rate of flow that can be handled by a 2 in. pipe over a run of 500 ft, with initial pressure of 8 in. WG and a pressure drop not to exceed 4 in. WG. Proceed as follows:

Pressure drop is:

$$(4.0 \times 100)/500 = 0.8 \text{ in. WG} \quad \ldots\ldots\ldots\ldots [10]$$

Enter the chart at 0.8 in. for pressure drop, and extend over to a 2 in. pipe. The quantity of gas that can be handled is 1540 cfh. ‡



LOW PRESSURE GAS CHART simplifies design of piping by indicating required diameter, rate of flow, pressure drop, initial pressure, or final pressure when the rest of these values are known. The chart is based on the Spitzglass formula for the rate of flow in cubic feet of gas per hour At specific gravity of 0.60, with air = 1.00

The object of the Society is to advance the arts and sciences of heating, ventilating, cooling and air conditioning, and the allied arts and sciences, for the benefit of the general public, to encourage and conduct scientific research, and to cooperate with other organizations having the same or similar objectives.

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Heating, Piping & Air Conditioning

Journal Section

of the

AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

AIR FROM RADIAL OUTLETS ON CEILING

Another in the series of papers resulting from the Society research cooperative project with Case Institute of Technology on air distribution. Here the matter of speed of air coming out of radial flow outlets is discussed. There is a formula for computing this speed and a practical example is worked out. See page 139.

DEHUMIDIFICATION

Two of the five papers included on the program at the Symposium on Dehumidification at the Chicago Meeting in February are here in full. One deals with the use of solid sorbent materials for drying air (page 161) while the other tells how some dehumidification problems have been solved (see page 164).

MURRAY BAY IN JUNE

It is not too early to start your plans to be at the Semi-Annual Meeting in Murray Bay, Quebec, Canada, on June 24 to June 26. The program is shaping up. See page 169.

SOCIETY COMMITTEE ORGANIZATION

General Committees: The By-Laws provide for 9 such committees. The latest listing was included in January 1957 issue on pages 218-19

Research Committees: The research program is under the guidance of the Committee on Research — a General Committee. The Committee on Research appoints Technical Advisory Committees as needed. Latest list, with current membership, appeared in January 1957 issue 218-19

Special Committees: At present there are 9 of these committees. Latest list of them and of their personnel can be found in the January 1957 issue on page **219**

Nominating Committee: This committee's membership is fixed by the By-Laws.

SOCIETY REGIONAL ORGANIZATION

Names of the Regional Directors and a list of members of the Chapters Regional Committees appears in this issue on page 176

SOCIETY CHAPTERS AND BRANCHES

The Society has chartered 67 Chapters, 1 Special Branch, and 6 Student Branches. These groups elect their officers and governing boards. A list of the presidents and secretaries appears in the February JOURNAL on pages .. 267-68

The President's Page

ASHAE and the Engineers Joint Council

IN the fall of 1956, the ASHAE was admitted to membership in the *Engineers Joint Council (EJC)*. ASHAE officers John W. James, E. R. Queer and P. B. Gordon attended their first meetings as ASHAE representatives to the *EJC* Board of Directors during November 1956 and January 1957.

The nine member constituent societies that make up the *EJC* as of now are:

- *American Society of Civil Engineers (ASCE)*
- *American Institute of Mining, Metallurgical & Petroleum Engineers (AIME)*
- *American Society of Mechanical Engineers (ASME)*
- *American Water Works Association (AWWA)*
- *American Institute of Electrical Engineers (AIEE)*
- *American Society for Engineering Education (ASEE)*
- AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS (ASHAE)
- *American Society of Refrigerating Engineers (ASRE)*
- *American Institute of Chemical Engineers (AIChE)*

EJC is a federation of 9 constituent societies and, together with 2 associate societies and 2 affiliate societies, represents over 220,000 society members in the engineering world. These engineering societies, all concerned with technical and professional problems in their own sphere of engineering interests, are using the *EJC* as their advisory and coordinating agency on matters of mutual interest, wherein parallel action by some or all of the societies is of advantage to the engineering profession as a whole.

EJC is continuing to grow in its importance and stature as the *unity organization* for the engineering world. For over 50 years, engineers favored some kind of single agency through which the several separate national engineering societies could work together for the solution of problems of common concern and to make the voice of the engineering profession emphatically heard wherever and whenever needed. The story of the origin and development of *EJC* (as presently constituted), though interesting, is rather lengthy for inclusion in this page.

Briefly, the present *EJC* developed during the period 1952-1954, as an outgrowth of an earlier *EJC* created during World War II to permit the engineering profession to better collaborate with the nation's war effort. As presently organized, the objectives of the *Engineers Joint Council* are:

1. To advance the general welfare of mankind through the available resources and creative ability of the engineering profession.
2. To promote cooperation among the various branches of the engineering profession.
3. To advance the science and profession of engineering.
4. To develop sound public policies respecting national and international affairs, wherein the engineering profession can be helpful through the services of the members of the engineering profession.

Most of the work of the *EJC* is carried out through activation of special projects and through the activities of its standing and special task committees and commissions. One of these projects now under way exemplifies these operations.

1957 Nuclear Congress: The first such congress was held in 1955 in Cleveland, and the Second Nuclear Engineering and Science Congress and the International Atomic Exposition is being held in Philadelphia's Convention Hall during March 11-15, 1957. The sessions serve to bring together leaders in science, engineering, industry, government, education and other fields. This Nuclear Congress is sponsored not only by the engineering societies of the *EJC*, but by the *American Nuclear Society* and other scientific and management societies and groups. One-hundred thirty technical papers are scheduled for the conference, as well as many round-table meetings. Attendance figures are not yet available but should exceed 1955 figures—3000 at the congress and 18,000 visitors to the Exposition.

Other EJC activities under way as of this time are:

- Air Pollution Committee
- Atomic Energy Panel
- Committee on Consulting Practice
- Committee on Employment Conditions of Engineers
- Committee on Engineering Sciences
- Engineering Manpower Commission
- Committee on International Relations
- Labor Legislation Panel
- National Engineers Register (for the National Science Foundation)
- National Water Policy Panel
- Practice of Engineering
- Survey of the Engineering Profession
- Problems of Higher Education and the Engineering Profession
- Committee on Honors for Engineers
- Who's Who in Engineering
- Committee on Abstracting Services

It will be interesting to note during the coming year how this program of collaboration between the several engineering societies works. From time to time, I will keep you informed.

P. B. Gordon
President
AMERICAN SOCIETY OF HEATING AND
AIR-CONDITIONING ENGINEERS

Jet Velocities from Radial Flow Outlets

By Alfred Koestel*, Cleveland, Ohio

This paper is the result of research sponsored by the American Society of Heating and Air-Conditioning Engineers, in cooperation with Case Institute of Technology, Cleveland, Ohio

SUMMARY — A general equation for computing velocities in radial jets is presented. The equation is compared with laboratory measurements made on jets produced by radial slots and nozzles, plaques and diffusers.

Ceiling distribution of air is accomplished by air outlets which may conveniently be divided into ceiling plaques and ceiling diffusers. Diffusers and plaques usually discharge their flow parallel to the surface (wall or ceiling) in which they are mounted. This is referred to as *flush mounted*. However, the flow might also be partially free of surface interference if mounted on say, exposed ductwork. This difference in mounting is important, as it influences the performance of the outlet. A plaque has a single deflecting surface and therefore a single air passage for discharging air.† (See Fig. 1). A diffuser is sometimes defined as a manufactured and laboratory tested device for distributing air. A diffuser having multi-deflecting type air passages arranged in parallel is shown in Fig. 2. Commercial ceiling diffusers have been developed to overcome the shortcomings of the simple plaque, but both groups belong to the large class of radial flow outlets, as the simplest representatives of which may be considered the radial nozzle and the radial slot shown in Fig. 4.

In some diffusers the air discharge flow rate is not uniform in all radial directions. In this paper we are concerned with the jet velocities in a uniformly distributed circumferential air jet formed by diffusers, plaques, and radial nozzles or slots.

The basic air jet flow pattern which was analytically investigated is shown in Fig. 3. Many geometrically different types of radial flow outlets were experimentally investigated in order to determine the effect of outlet geometry on the air jet velocities and flow pattern. These outlets are listed in Table 1. The test results on some of the outlets of Table 1 are also presented in Reference 1, which should also be consulted for some relevant remarks on the performance of radial flow outlets.

Nomenclature

V_c = maximum velocity in air jet, fpm feet per minute.

$\sqrt{2gh}$ or V_o = maximum outlet velocity (computed from total pressure difference between supply air and ambient room air, i.e., $V_o = \sqrt{2gh}$ where h is the total air pressure in feet of air.

V'_o = velocity leaving plate edge of plaque-type outlet, see Fig. 1, fpm.

R = distance from geometric center of outlet to where maximum jet velocity is V_c, feet.

R_o = radius of outlet, feet.

H_o = width of slot opening in outlet, or distance between plate surface and nozzle face for plaques, feet.

D_o = diameter of plaque, feet or inches.

D_n = diameter or equivalent diameter of supply opening behind plaque, feet.

H_e = effective width of jet being discharged from outlet, feet.

N = number of conical type deflectors in parallel in a diffuser on which air is radially deflected.

θ = horizontal deflection of air stream, degrees.

C_d = coefficient of discharge, dimensionless.

C = constant.

K = length of the constant velocity core in terms of the width, H_o, of the circular slot (or in terms of the diameter for a jet issuing from a simple nozzle). If the Reynolds number of the jet evaluated at the outlet is large enough, K = 6.5 diameters for a nozzle, and K = 6.5 slot widths for a slot, dimensionless. See Reference 1.

ΔP = pressure drop across outlet in inches of water.

cfm = air-flow rate in cubic feet per minute.

Basic Equation

When the principle of conservation of momentum is applied to the air jet in Fig. 3, the centerline velocity (maximum jet velocity) can be found by Equation 1, which is a basic equation developed for describing the performance of all outlets belonging to the *radial flow outlet* class.

$$V_c/V_o = \frac{\sqrt{K(H_o/R_o)\cos\theta[K(H_o/R_o)\cos\theta+1]}}{\dfrac{\sqrt{R(R-R_o)}}{R_o}} \qquad \text{-------------------(1)}$$

Fig. 3 shows the basic flow pattern of an isothermal jet discharged from a simple radial flow outlet into a free space which is *in no way* restricted.

Since many radial flow outlets are flush mounted to a surface, the radial jet produced will flow along the surface and entrainment will take place on only one side of the jet. This increases the jet velocities by a factor of $\sqrt{2}$. See Reference 1 for a discussion of this. To find the maximum jet velocity for *flush* mounted outlets, the values found with help of Equations 1 and 2 must be multiplied by the factor $\sqrt{2}$.

The detailed mathematical analyses (on which Equation 1 is based) appear in the Appendix*. It is planned to publish this with the paper in the 1957 Transactions.

The value of the numerator of the right-hand side of Equation 1 depends on the geometric configuration of the outlet. The denominator represents the dimensionless distance from the outlet in terms of outlet radius to the point where the maxi-

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*Associate Professor of Mechanical Engineering, Case Institute of Technology. Member of ASHAE.

†A plaque is sometimes considered as an air distribution device manufactured in the field and similar to the one shown in Fig. 1.

For presentation at the Semi-Annual Meeting of the American Society of Heating And Air-Conditioning Engineers, Murray Bay, Canada, June 1957.

*Mimeographed copies of the Appendix may be obtained on request from the ASHAE Laboratory, until published in Transactions.

mum jet velocity is V_c. For a given diffuser or a plaque Equation 1 becomes:

$$V_c/V_o = \frac{C}{\frac{\sqrt{R(R-R_o)}}{R_o}} \text{------------------}(2)$$

(also see Equation A-12, Appendix) when C, a constant, can be experimentally determined, by test. V_o is computed from the total pressure drop across the diffuser if no losses are assumed. Empirical formulas describing the jet velocity behavior from ceiling diffusers have been in use for many years. These formulas usually take the following form:

$$\text{Throw} = (\text{constant}) \times (\text{volumetric flow rate})/\sqrt{\text{Effective Area of the outlet}} \ldots\ldots\ldots\ldots(3)$$

where,

Throw = distance from outlet to where the jet velocity has a predetermined value, such as, 50 fpm or 100 fpm. The constant is determined by test.

It can be shown that Equation 3 is similar to Equation 2 if the distance from the outlet is large enough so that the quantity ($R - R_o$) is approximately equal to R.

The term H_o/R_o in Equation 1 — where H_o is the width of the slot of the radial flow outlet shown in Fig. 3 — can be easily determined for simple radial flow outlets, such as shown in Fig. 4. It is difficult to evaluate for outlets with more complex geometrical configurations, particularly commercial diffusers, but the following approach can be used for plaques. For example, consider a circular plaque outlet in which the deflecting plate is relatively far from the *neck* or nozzle as shown in Fig. 1. If it is assumed that the flow rate leaving the nozzle is equal to the flow rate issuing from the circumferential edge of the plate, (amount of en-

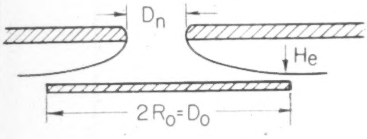


Fig. 1 — Plaque

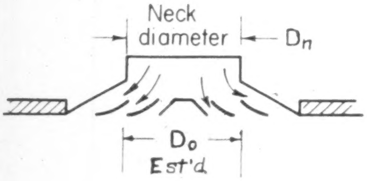


Fig. 2 — Diffuser

Table 1 — Results of Outlets Tested

Identification No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Type of Outlet (see Figs. 1, 2, 4)	Plaque												
Value of C in *Equation* 2 from jet velocity *vs.* radial distance data, Fig. 6	0.285	0.275	0.210	0.220	0.280	0.290	0.680	0.670	0.530	0.575	0.320	0.330	1.50
Dimensions of outlet in inches[a] (see Figs. 1, 2, 4)	(24) x ($5\frac{7}{16}$) x (½)	(24) x ($5\frac{7}{16}$) x (1)	(24) x ($5\frac{7}{16}$) x (1½)	(24) x ($5\frac{7}{16}$) x (2)	(24) x ($5\frac{7}{16}$) x (3)	(24) x ($5\frac{7}{16}$) x (4)	(24) x (4 x 4) x (½)	(24) x (4 x 4) x (1)	(24) x (4 x 4) x (1½)	(24) x (4 x 4) x (2)	(24) x (4 x 4) x (3)	(24) x (4 x 4) x (4)	($5\frac{7}{16}$) x ($5\frac{7}{16}$) x (½)
H_o/R_o	0.0416	0.0832	0.125	0.167	0.250	0.333	0.0417	0.0832	0.125	0.167	0.025	0.333	0.184
H_e/R_o By *Equa.* 4	0.0258	0.0258	0.0258	0.0258	0.0258	0.0258	0.0178	0.0178	0.0178	0.0178	0.0178	0.0178	0.500
H_e/R_o By *Equa.* 5													
Identification No.	14	15	16	17	18	19	20	21	22	23	24	25	26
Type of Outlet (see Figs. 1, 2, 4)	Plaque							Radial Slot 3[b]	Radial Nozzle 3[b]				Diffuser
Value of C in *Equation* 2 from jet velocity *vs.* radial distance data, Fig. 6	1.27	1.27	0.590	0.550	0.600	1.55	1.80	1.00	1.05	0.400	0.340	0.490	0.85
Dimensions of outlet in inches[a] (see Figs. 1, 2, 4)	($5\frac{7}{16}$) x ($5\frac{7}{16}$) x (1)	($5\frac{7}{16}$) x ($5\frac{7}{16}$) x (1½)	(14) x ($5\frac{7}{16}$) x (½)	(14) x ($5\frac{7}{16}$) x (1)	(14) x ($5\frac{7}{16}$) x (2)	(14) x (14) x (1)	(14) x (14) x (2)	(14) x (1)	2.32 x (¼)	(11½) x (½) Nozzle angle 45	(11½) x (¼) Nozzle angle 45	(11½) x 0.219; Nozzle angle 45	8-inch neck diam. $\theta = 25°$ (see Fig. 2)
H_o/R_o	0.369	0.553	0.0714	0.143	0.286	0.143	0.286	C_d=0.6 0.0857	C_d=1.0 0.216	C_d=1.0 0.087	C_d=1.0 0.0435	C_d=1.0 0.0381	— —
H_e/R_o By *Equa.* 4	0.500	0.500	0.0755	0.0755	0.0755	0.500	0.500	—	—	—	—	—	0.5
H_e/R_o By *Equa.* 5													N = 3 0.167

[a] For plaques: Plaque diameter in inches; Nozzle diameter in inches; Distance between plaque and face of nozzle in inches.

[b] For radial slots or nozzles: Outer duct or pipe diameter in inches; Width of slot or nozzle in inches.

trainment in this region considered negligible), then,

$$(\pi D_n^2/4)\, V_o = V'_o\, \pi\, D_o\, H_e$$

and assuming that $V_o \approx V'_o$ (constant total head at the same ambient static pressure), this equation changes to:

$$\tfrac{1}{2}\,(D_n/D_o)^2 = H_e/R_o \text{..........} (4)$$

where

H_e/R_o = equivalent to H_o/R_o for the simple radial flow outlets shown in Fig. 4.
H_e = the effective width of the jet discharged from the outlet. (See Fig. 1.)

If the deflecting plate of the plaque type outlet of Fig. 1 is relatively near the neck of the nozzle so that the width of the jet is equal this distance, H_o, Equation 4 is not applicable since V_o is not equal to V_o' when the flow is restricted in this manner. In this case the term H_o/R_o is less than the term H_e/R_o, as computed from Equation 4, and should be used in Equation 1.

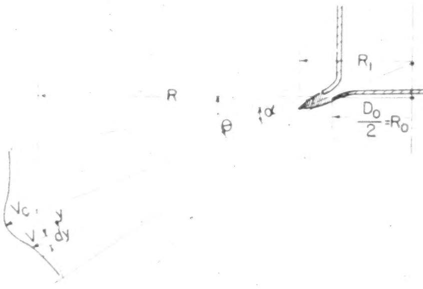


Fig. 3 — Basic radial jet

Example: A flow of 500 cfm from a nozzle 1 ft in diameter impinges on a plaque located 6 in. from the face of the nozzle. The nozzle face is mounted flush in a ceiling. Find the maximum jet velocities 10 ft from the center of the plaque if the plaque diameter is (a) 2 ft in diameter, (b) 4 ft in diameter. Assume K equal to 4 and θ equal to zero in both cases. V_o *through the nozzle is* $500/\pi\,(1/4)^2$ = *636 fpm in both cases which is also approximately equal to the jet velocity leaving the edge of the plaque if losses are negligible.*

Solution (a):
$H_e/R_o = \tfrac{1}{2}\,(\tfrac{1}{2})^2 = 0.125$ which is less than

$H_o/R_o = (6/12)/1 = 0.5$ which indicates that the width of the jet is less than 6 in. which makes Equation 4 applicable.
Applying Equation 1,

$$V_c/636 = \frac{\sqrt{4 \times 0.125\,[4 \times 0.125 + 1]}}{\dfrac{\sqrt{10(10-1)}}{1}} = 0.866/9.49$$

V_e = 58.0 fpm if the jet were totally free, and $V_c = 58 \times \sqrt{2} = 82$ fpm since the jet flows adjacent to a surface. *Note:* C in Equation 2 is 0.866 for this case.

Solution (b):
$H_e/R_o = \tfrac{1}{2}\,(\tfrac{1}{4})^2 = 0.0312$ which is again less than
$H_o/R_o = (6/12)/2 = 0.25$ making Equation 4 applicable.
Applying Equation 1,

$$V_c/636 = \frac{\sqrt{4 \times 0.0312\,[4 \times 0.0312 + 1]}}{\dfrac{\sqrt{10(10-2)}}{2}} = 0.375/4.47$$

V_c = 53.4 fpm if the jet were totally free, and $V_c = 53.4\,\sqrt{2} = 75.5$ fpm since the jet flows adjacent to a surface. *Note:* C in Equation 2 is 0.375 for this case.

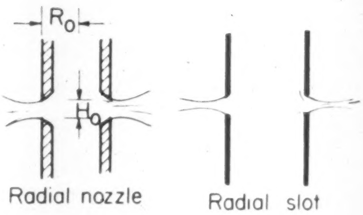


Fig. 4 — Radial outlets

The results show that the maximum jet velocities 10 ft from the plaque are practically the same in both cases. This is understandable since the initial momenta are the same. It is the differences in H_e/R_o and R_o which contribute to the small difference in jet velocities for the 2 plaques.

Plaque with Multi-Deflecting Plates

Now consider a plaque similar to Fig. 5 with N plates and apply the continuity equation, and

$$\pi D_n^2/4 = \pi\, D_o\, N\, H_e$$

providing the plates are equal in diameter, the distances H_e equal in magnitude, and the velocities of the jets leaving the edge of each plate are the same. This simplification results in:

$$\tfrac{1}{2}\,(D_n/D_o)^2\,(1/N) = H_e/R_o \text{...} (5)$$

where

H_e/R_o = equivalent to H_o/R_o with the same restrictions as previously pointed out.

If each deflecting plate in Fig. 5 has a different diameter as is the case for typical diffusers, then R_o or D_o in Equation 5 might represent some mean value.

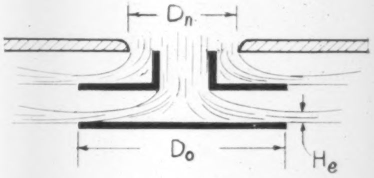


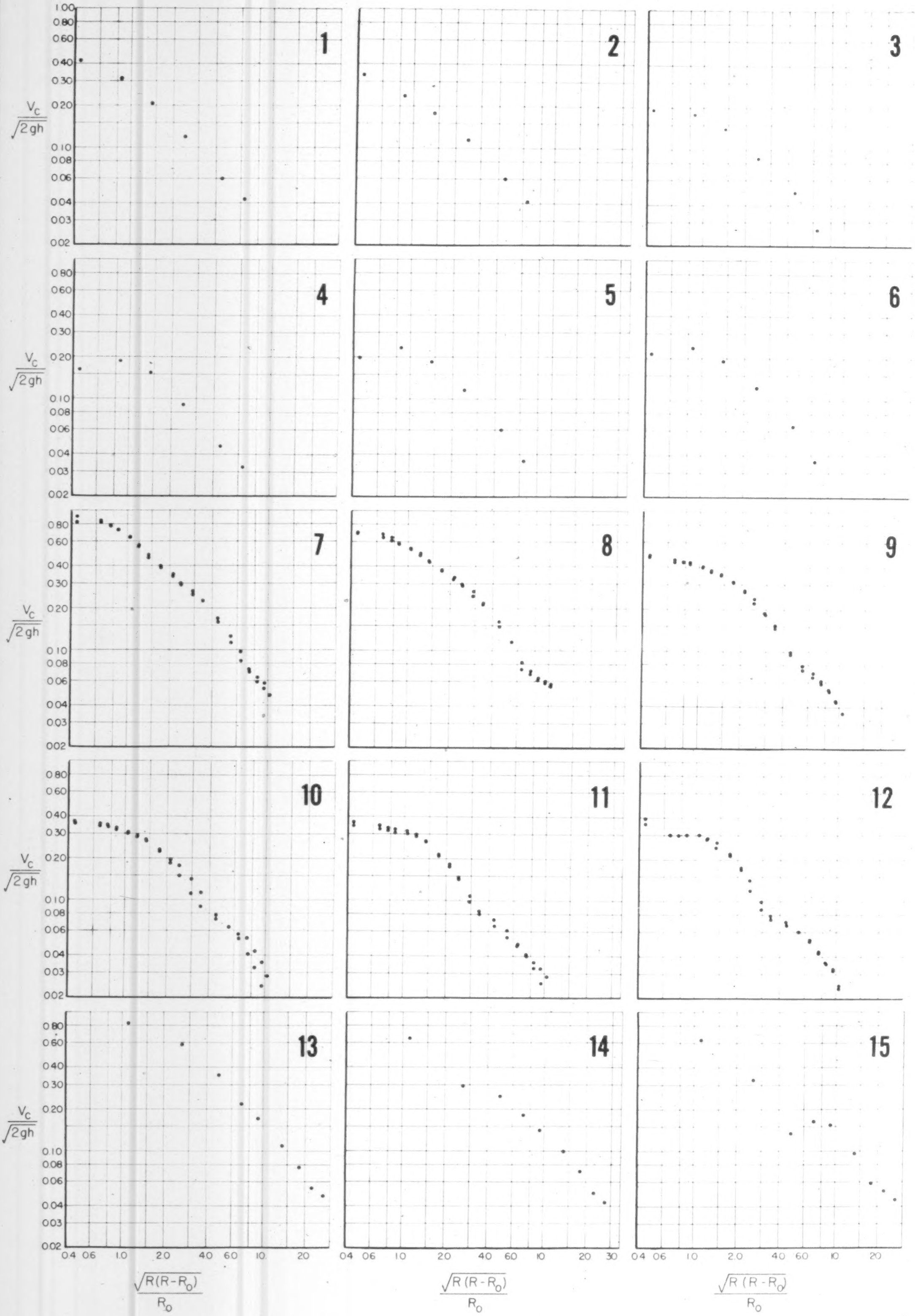
Fig. 5 — Plaque with deflecting plates in parallel

It should be realized that actual diffusers used in practice produce flow patterns on their deflecting plates which are more complex than the idealized situation illustrated in Fig. 5.

Theoretically adding deflecting plates in parallel as in Fig. 5, reduces H_e/R_o for a fixed flow rate, and according to Equation 1, this reduces the ratio, V_c/V_o at a given distance from the outlet. This reasoning applies if the individual radial jets produced per deflecting plate do not coalesce into a single jet. Actually the jets will merge at a certain distance from the outlet (see Reference 2) and as a result the effect produced by adding deflecting plates or cones will be minimized.

Results

In Fig. 6 the test results obtained for each outlet described in Table 1 are plotted in accordance with Equation 2. The experimentally determined value of C of Equation 2 as well as H_o/R_o and H_e/R_o for each outlet are listed in Table 1. All of



the outlets described herein were tested under isothermal conditions.

In Fig. 7 an attempt is made to correlate the experimentally determined constant, C, of Equation 2 with either H_o/R_o or H_e/R_o depend-

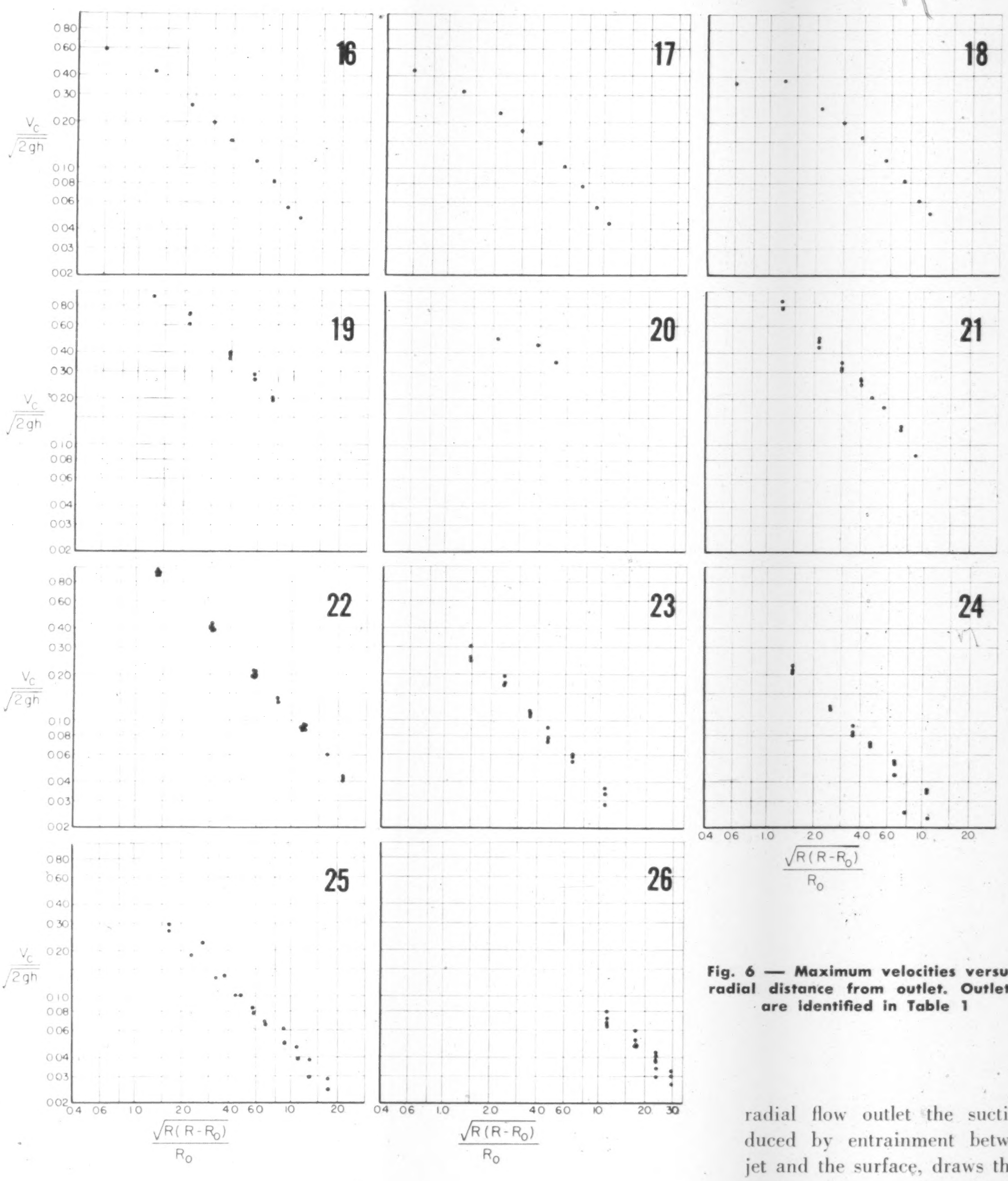


Fig. 6 — Maximum velocities versus radial distance from outlet. Outlets are identified in Table 1

ing on their values found with help of Equation 4. If H_c/R_0 is less than H_0/R_0, for plaques, then the value of H_c/R_0 is used in the abscissa of Fig. 7. The test points are compared with curves of Equation 1 for K equal to 4 with and without the factor, $\sqrt{2}$, for flush mounted radial flow outlets. For outlets with high Reynolds numbers (large size and high velocities) K is approximately 6.5. Normally the width H_0 or H_c, of the jet produced by a plaque or diffuser is small compared to the diameter of a jet produced by a straight flow grille or nozzle. Therefore, K values can be expected to be less than 6.5 (also see Reference 1), and a value of $K = 4$ has been selected. This makes the curves of Equation 1 compare favorably with the test points.

The curves of Equation 1 plotted in Fig. 7 are determined with θ equal to zero. When θ is somewhat greater than zero for a flush mounted radial flow outlet the suction produced by entrainment between the jet and the surface, draws the jet up to the surface, so that the jet effectively behaves as if there were no deflection at the outlet. Jet velocities are then increased by a factor $\sqrt{2}$ due to reduced entrainment on one side.

Fig. 8 shows the coalesence of a jet due to vacuum in void space produced by outlets 23, 24, and 25 which were not flush mounted, and produced a radial jet at an angle, θ, equal to 45 deg. This phenomena was observed at all flow rates which indicates that this phenomena depends on the geometry of the outlet. When the outlet was flush mounted and a small hole drilled in the deflecting plate so that supply air can fill the void without creating a suction, the radial jet was drawn up to the mounting surface due to the suction produced in the region between the radial jet and the surface. Although outlets Nos. 23, 24, 25, have radial nozzles set at an angle of 45 deg (see Fig. 8), the free jet at a distance from the discharge face flowed along the wall as if emanating from a radial outlet with θ equal to zero. Therefore, in plotting the test data in Fig. 7, $\theta = 0$ was used. Figs. 6 and 7 also contain test results for the only commercial diffuser tested (outlet No. 26), which is a typical commercial outlet similar to the one shown in Fig. 2.

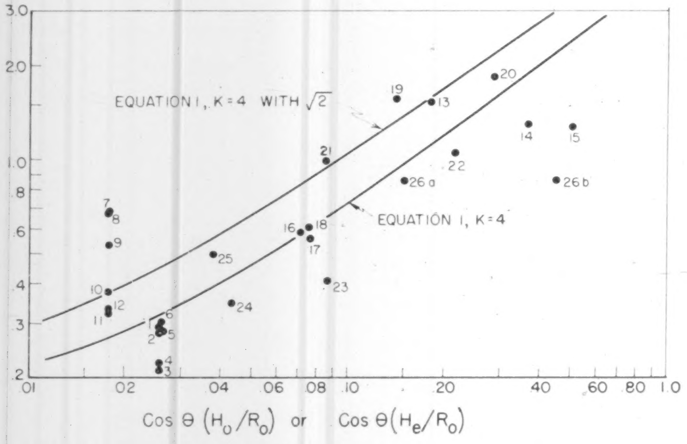


Fig. 7 — Correlation of test data from 26 outlet types in accordance with Equation 1. Numbers with points refer to Table 1

Outlet No. 26 was the only outlet tested which formed a radial jet with an effective deflection greater than zero. The outlet was mounted exposed in a manner similar to the outlet shown in Fig. 8. In Fig. 7 two points are shown for the plotted symbol of outlet No. 26. Point *26a* is for H_e/R_o computed from Equation 5 with $N = 3$, and point *26b* is for H_e/R_o computed from Equation 4. In both cases, θ, (measured flow deflection) was 25 deg. The ratio D_n/D_o was estimated as unity (see Fig. 2). Since point *26a* is closer to the theoretical curve of Equation 1 than point *26b*, indications are that the deflecting cones may be effective in reducing H_e/R_o and the *throw*. However, no definite conclusion should be drawn since some experimenters have found that multiple deflecting cones are not effective in reducing the *throw*.

Commercial Diffusers

Manufacturers of commercial diffusers publish test data on their products which as a rule are not presented in a manner which permits a direct comparison between these data and the equations presented in this paper. However, by judicious manipulation of Equation 1, a comparison can be made with catalog data.

Normally manufacturers present their *throw* data (distance from outlet to a prescribed terminal velocity) as a function of flow rate in cubic feet per minute and air pressure behind outlet in inches of water. If the following substitutions are made into Equation 1: — $A_e = 2\pi R_o H_e$; $A_e = \text{cfm}/V_o$; $V_o = 4005\sqrt{\Delta P}$ (for standard air density of 0.075 lb per cu ft); $K = 4.0$; $\sqrt{[R(R-R_o)]}$ is approximately equal to R if R_o is small contrasted to R; and Cos $\theta = 1$, we obtain Equation 6, thus

$$\frac{V_c R}{\Delta P^{0.25}\sqrt{cfm}} = 50.3\sqrt{1+\frac{0.00016\times(cfm)}{\sqrt{\Delta P}\quad R_o^2}} \quad (6)$$

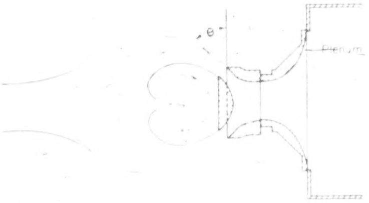


Fig. 8 — Exposed radial nozzle (not flush mounted in wall) showing coalescense of jet due to vacuum in void space

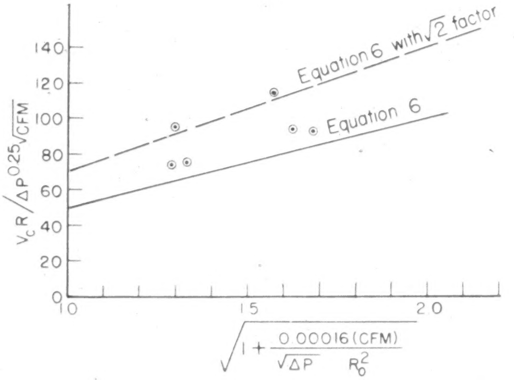


Fig. 9 — Comparison of Equation 6 with data obtained from a diffuser manufacturer

Equation 6 is plotted in Fig. 9 with and without the $\sqrt{2}$ multiplying factor applied to the right side of Equation 6. Published data obtained from a manufacturer's catalog are also plotted (symbols) for comparison with Equation 6. The plotted data represents: (1) three geometrically different diffuser types; (2) 240 to 7600, (cfm); (3) 0.122 to 0.249 in. of water, (ΔP); (4) 3 to 5 deflecting cones, (N); (5) 100 to 200 fpm. (V_c); (6) 7 to 42 ft, R; and (7) 8 to 38 in., diffuser neck diameter.

R_o in Equation 6 was arbitrarily taken as one-half the neck diameter in feet. According to the catalog the diffusers were all flush mounted in the ceiling.

The effect of N (number of deflecting cones) on the product (V/R) in Fig. 9 or in Equation 6 was assumed minor. The data plotted in Fig. 9 indicated that this was the case and that Equation 5 was not applicable in the derivation of Equation 6. This contradicts the implication made in contrasting point 26*a* with point 26*b* in Fig. 7 for outlet No. 26 which is a commercial diffuser with 3 cones.

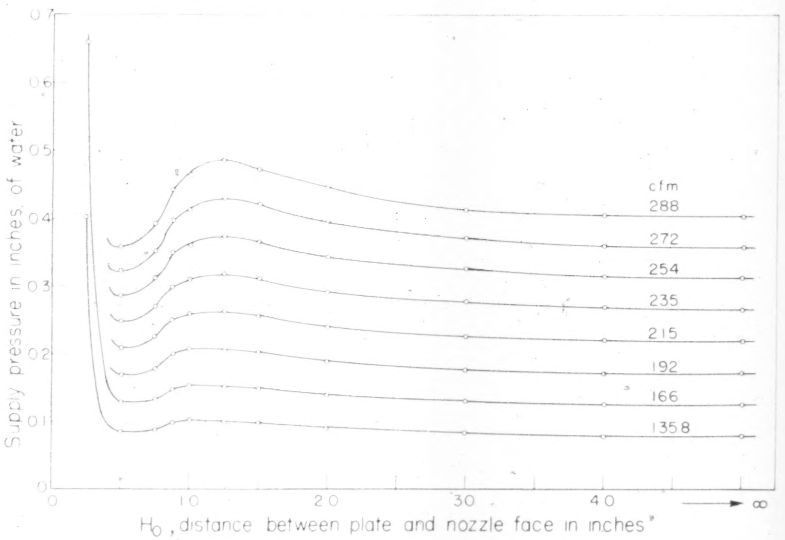


Fig. 10 — Effect of distance, H_0, on supply pressure for a 24-in. diameter plaque with a 5-7/16-in. nozzle

Some Experimental Observations

Several calibrated anemometers were used to measure the jet velocities: *i.e.*, thermal-anemometers, bridled vane anemometers and total head tubes. As many as 6 observers were involved during a period of 3 years of testing and the instrument used depended on the preference of the individual.

During the tests many detailed measurements were made which, if presented in this paper, would be too voluminous. Therefore, only some representative measurements of interest are herein reported. In Fig. 10 is shown the effect of plaque height, H_0, on the required nozzle pressure behind the outlet for various flow rates impinged on a 24-in. diameter plaque. The characteristic *dip* in pressure at a plaque height of ½ in. as shown in the figure is typical of plaque type outlets. The *dip* was observed at a plaque height of ¾ in. when a 14-in. diameter plaque was placed in front of the nozzle.

In Fig. 11 are shown centerline static pressure traverses made between the face of the nozzle and the face of the plaque.

Velocity profiles were measured near the edge of the plaques. When the plaque height was small the velocity profiles were uniform as shown in Fig. 12 for a height of ½ in. with a 24 in. diameter plaque and a 5-7/16 in. diameter nozzle. As the plaque height is increased a turbulent region forms adjacent to the wall behind the plaque and extending a small distance from the edge of the plaque. This is illustrated in Fig. 13 for a plaque height of 4 in. (24-in. diameter plaque; 4-in. by 4-in. square nozzle). The flow from the nozzle is directed along the surface of the plaque and a counterflow (negative velocities shown in Fig. 13) stream is indicated near the wall. When the flow is clear of the plaque the free jet is drawn to the wall surface due to vacuum created in the

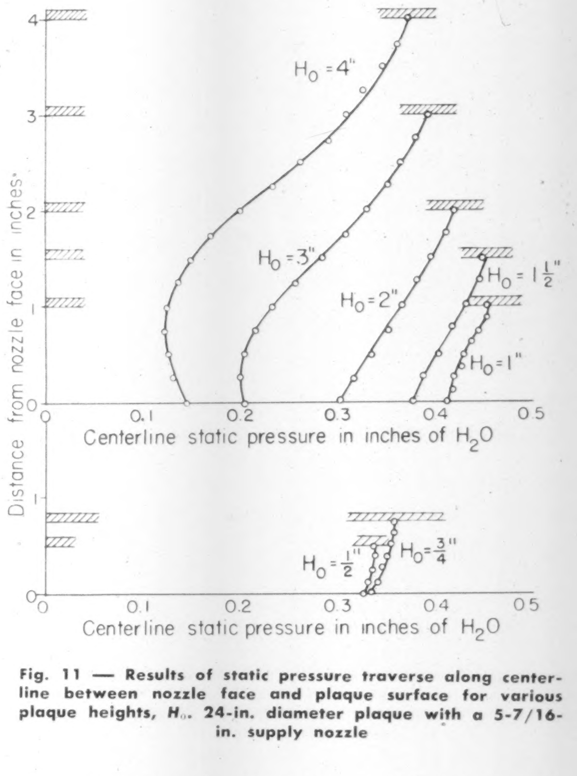


Fig. 11 — Results of static pressure traverse along centerline between nozzle face and plaque surface for various plaque heights, H_0. 24-in. diameter plaque with a 5-7/16-in. supply nozzle

turbulent or counterflow regions. Some velocity profile data on plaque type outlets were also reported in Reference 1.

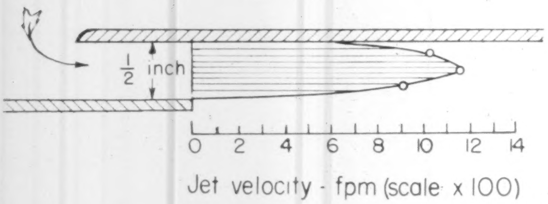


Fig. 12 — Jet velocity profile at edge of plaque. 24-in. diameter plaque with a 5-7/16-in. diameter supply nozzle. H_o equal to ½ in.

Conclusions and Recommendations

The equations presented in this paper form a basis for a designer of air distribution systems to estimate air velocities in air jets from radial flow outlets under isothermal conditions. The equations may also provide guidance for experimental evaluations of air jets from radial flow outlets.

The complex nature of the air flow through the various outlet configurations covered in this paper makes the theory only a crude approximation of the actual conditions. This can readily be realized by examining Fig. 7 in which the experimental data are compared with the curves of Equation 1. The actual jet flow through the various outlets involves complex eddy, turning, and impact losses which are not taken into account in the formulation of Equation 1. In addition the radial jet theory presented in the Appendix is based on conservation of momentum which is known to be only an approximation in a free air jet. Care should be taken when applying Equation 1 to practical type outlets because of the difficulty of estimating the value of the term H_o/R_o. Experimental data should be relied upon whenever possible.

Due to the many possible configurations of diffusers additional experimental work is recommended.

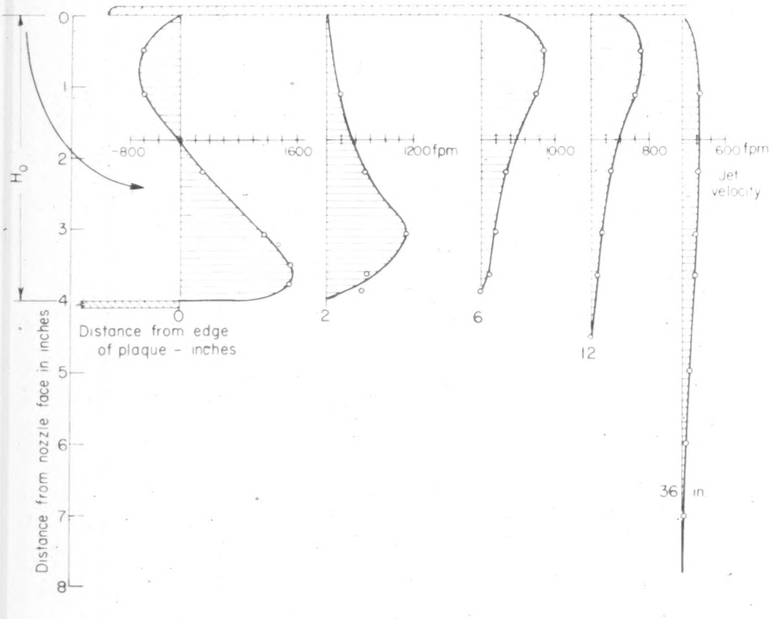


Fig. 13 — Velocity profiles produced by a jet from a 24-in. diameter plaque with a 4 by 4-in. square nozzle; H_o equal to 4 in.

The work should be directed toward the accurate determination of the effect of diffuser geometry on the term H_o/R_o in Equation 1. The material presented in this paper is extensive in nature rather than intensive which should be the philosophy for future work in radial flow outlets.

Acknowledgments

The author is indebted to Prof. G. L. Tuve for his help and suggestions. The experimental work was performed over a period of several years by K. Kjolner, E. Jones, W. Kerka, E. Cox, and B. Davis, students in mechanical engineering. The figures were prepared by Mrs. Ruth Strahosky.

References

1. ASHAE Research Report No. 1476 — Air Velocities in Ventilating Jets, by G. L. Tuve. (ASHAE Transactions, Vol. 59, 1953, p. 261).

2. ASHAE Research Report No. 1580 — Air Velocities in Two Parallel Ventilating Jets, by Alfred Koestel and J. B. Austin, Jr. (ASHAE Transactions, Vol. 62, 1956, p. 425).

SEMI-ANNUAL MEETING

Murray Bay, Que., Canada — June 24-26, 1957

Performance Testing of Roof Ventilators

By J. J. Wannenburg*, Pretoria, South Africa

***Summary* — Prediction of ventilator performance from wind tunnel test results involves the *free inlet correction*, which is necessitated by the discrepancy between test conditions, where a duct or suction pipe has to be attached to the ventilator stack, and practical conditions, where the ventilator usually operates without such an extension. A theoretical method for obtaining this correction and the experimental verification of the theory are considered. This theory results in a simplification of test procedure and allows for calculation of performance at any value of windspeed, wind direction and suction pipe resistance. A test on a typical roof ventilator is described and certain other factors, such as *stack effect*, which contribute to air extraction through a ventilator, are briefly considered.**

APPLICATION of natural draft roof ventilators to industrial buildings has made apparent the necessity of developing a method whereby the performance of these ventilators may be conveniently tested. The purpose of such tests would be to obtain data to serve (*a*) as a basis for the comparative rating of ventilators, and (*b*) for the prediction of ventilator performance under practical conditions. The investigations, of which the results and conclusions are given here, were directed towards development of a test method which could be applied with expedience to the routine testing of ventilators.

Essentially, 3 factors contribute to the movement of air through a natural draft roof ventilator, viz:

1. Acceleration of air in the vicinity of the ventilator head causes a depression which results in the extraction of air from the building. This is the *aspiration effect*. Its magnitude is a function of ventilator shape, and of windspeed and wind direction at the ventilator.

2. If the outside air is cooler than air inside, the warmer air will move through the ventilator to the cooler outdoor environment. This is the *chimney* or *stack effect*.

3. Generally, in the case of a building exposed to wind, a positive pressure exists over the windward walls, and a negative pressure over the roof and leeward walls[1]. If there are openings in the roof and walls, movement of air results, inward through the windward openings and outward through the leeward and roof openings[2]. Thus there is an additional extraction of air through a roof ventilator, and this flow does not depend upon ventilator shape, but upon wind condition, the resistance to flow of the ventilator, and its position on the roof. In addition, the pressure causing the flow depends on the number and size of other ventilating openings.

This effect is here referred to as the *forced draft effect*, and it must be noted that it is not present during the testing of a ventilator in an open jet wind tunnel, the static pressure at inlet to the stack extension (or suction pipe) being, under these conditions, equal to that in the free windstream. It is clear, therefore, that the results of such a ventilator test give information pertaining only to the aspiration effect.

It was decided that the comparative smallness of the stack effect, and the dependence of the *forced draft effect* on such irreproducible factors as the structural features of the building, would not justify separate experimental evaluation of these effects, and a method is therefore given for estimating their magnitudes theoretically.

It would be difficult to calculate accurately the extraction of air through a ventilator without prior knowledge of the windspeed and wind direction at the actual location of a ventilator, and the static pressure at the stack inlet. Such prior knowledge implies either tests on the full scale building, or wind tunnel tests on a scale model. However, if the accuracy of the required information regarding the ventilator performance does not justify such procedures, a rough estimate may be obtained by assigning empirical or average values to the unknown factors.

It might be argued that, if test results can be applied only to obtain a rough estimate of ventilator performance, there is no point in seeking accuracy in these results. However, there is a purpose for which accurate test results are essential, and that is for the comparative rating of different types of ventilator. In this connection results obtained from tests in an open jet wind tunnel provide a convenient basis for comparison. As mentioned before, such results apply to the aspiration effect, and this effect, all other factors being equal, is dependent on ventilator shape and resistance.

Theoretical Considerations

Aspiration Effect and Free Inlet Correction: Testing of a roof ventilator necessitates use of a duct attached to the ventilator stack, in which the induced volumetric flow may be measured. This duct, which will be referred to as the *suction pipe*, increases resistance to air flow of the system, and since in practice a ventilator usually operates without any such extension (*i.e.* under *free inlet conditions*) a method had to be devised whereby test results could be corrected or extrapolated to free inlet conditions. To this end the following method was proposed by Schrenk[3,4].

Fig. 1 represents a ventilator attached to a suction pipe, the ventilator projecting into a windstream of velocity V fps. Let the resulting velocity of flow in the suction pipe be v_w fps, and let the static pressures as measured at positions (1) and (2) in the suction pipe be P_1 and P_2 respectively. Then the static depressions at (1) and (2) may be expressed as

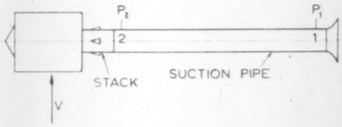


Fig. 1 — Diagrammatic representation of ventilator and suction pipe

$$\Delta P_1 = (P_a - P_1) \quad \ldots\ldots\ldots\ldots\ldots (1)$$
$$\Delta P_2 = (P_a - P_2) \quad \ldots\ldots\ldots\ldots\ldots (2)$$

where

P_a = atmospheric pressure.

Schrenk then introduced the nondimensional parameters ψ and η, where

$$\psi = v_w / V = \text{flow coefficient} \quad \ldots\ldots (3a)$$

and

$$\eta = (\Delta P_2 - \Delta P_1) / \tfrac{1}{2}\, \rho_0 v^2 = \text{pressure coefficient} \quad \ldots\ldots\ldots\ldots (3b)$$

ρ_0 = air density at wind temperature and the velocity of the free windstream.

Schrenk postulated that, if the orientation of the ventilator in the

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[1] Exponent numerals refer to References.

For presentation at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Murray Bay, Que., Canada, June 1957.

wind remains unchanged, then for all values of suction pipe resistance, the relation between ψ and η will be given by

$$\psi = \beta\ (\eta_{max} - \eta) \ \ldots\ldots\ldots\ldots\ (4)$$

where

η_{max} = value of η for a suction pipe of infinite resistance, *i.e.* when the duct is closed off (in which case $\Delta P_1 = 0$).

Equation 4 may be written in a slightly different form by introducing the parameter λ, where

$$\lambda = \Delta P_1/\tfrac{1}{2}\ \rho_0 V^2 \ \ldots\ldots\ldots\ldots\ (5)$$

Now, according to Bernoulli

$$\Delta P_1 = P_a - P_1 = (1 + K_1)\ \tfrac{1}{2}\,\rho_1 v_w^2$$

where

K_1 = resistance of that portion of the suction pipe upstream of the point (1).
v_w = airspeed in the pipe.
ρ_1 = average density of the air in the suction pipe.

Therefore

$$\lambda^2 = \Delta P_1/\tfrac{1}{2}\ \rho_0 V^2 = (1 + K_1)\ (v_w^2/V^2)\ (\rho_1/\rho_0) = (1 + K_1)\ (\rho_1/\rho_0)\ \psi^2\ .\ (6)$$

Hence, provided K_1 is constant and the densities remain unchanged, λ will be directly proportional to ψ. Schrenk's equation may now be written

$$\lambda = \alpha\ (\eta_{max} - \eta) \ \ldots\ldots\ldots\ldots\ (7)$$

$$\alpha = \sqrt{(1 + K_1\ \beta)} \ \ldots\ldots\ldots\ldots\ (8)$$

Equation 7 represents a straight line as shown in Fig. 2.

Thus, if 2 points A and B on this line are obtained experimentally, then the value of λ at $\eta = 0$ may be read off, this value corresponding to free inlet conditions (*i.e.* where $\Delta P_1 = \Delta P_2$). Substituting this value of λ (*i.e.* λ_0) into Equation 7 would yield the flow coefficient at free inlet conditions. It was implicitly assumed that the parameter ψ remained constant and independent of the windspeed, for a constant value of the suction pipe resistance; in other words, that the airspeed in the suction pipe was directly proportional to the windspeed, the factor of proportionality (ψ) being dependent on the resistance. This assumption was experimentally confirmed at a later stage in these investigations.

One aspect of Schrenk's method which renders its validity dubious, is the assumption implied in Equation 4, that a velocity should be directly proportional to a pressure, experience indicating that, for turbulent flow, pressures are proportional to the square of a velocity. On this account it was decided to obtain a theoretical relationship between the parameters employed by Schrenk. This relation would then be compared with Schrenk's empirical equation and would subsequently be subjected to experimental verification.

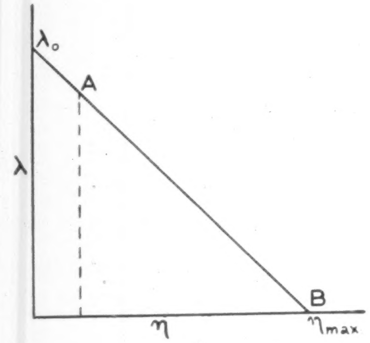


Fig. 2 — Schrenk's line

The arguments employed in this connection were based on the following assumptions:

1. For a particular orientation of the ventilator with respect to the wind, the dimensionless parameters ψ and $\Delta P/\tfrac{1}{2}\rho_0 V^2$ are constant for any value of V larger than about 3 fps, where ΔP is any depression as measured in the suction pipe, the lower limit of V being introduced to eliminate the possibility of non-turbulent flow.
2. The second assumption involves the static depression $\Delta P_3 = (P_a - P_3)$ which causes the flow through the suction pipe and ventilator, this depression being defined as

$$\Delta P_3 = (1 + K + K_v)\ \tfrac{1}{2}\ \rho_1 v_w^2 \ \ldots\ (9)$$

where

K = total suction pipe resistance.
K_v = ventilator resistance.
$\tfrac{1}{2}\rho_1 v_w^2$ = mean velocity head in suction pipe.

The depression ΔP_3 exists within the ventilator but, due to the intricate internal construction of the ventilator and the interference of the wind, it cannot, in general, be measured directly. There is, however, one condition where direct measurement is possible, and that is when the entrance to the suction pipe is closed off. Under these conditions it may be assumed that the depression ΔP_{inf} which exists within the ventilator also exists within the suction pipe. If now the resistance of the suction pipe is decreased from infinity to a value K, then there will be a certain amount of flow through the ventilator and the depression within the ventilator will change from ΔP_{inf} to ΔP_3. Assume now that

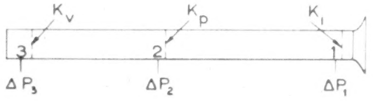


Fig. 3 — Equivalent system for ventilator and suction pipe

$$\Delta P_3 = \Delta P_{inf} - x\ \tfrac{1}{2}\ \rho_1 v_w^2 \ \ldots\ldots\ (10)$$

where

x = a parameter depending only upon the relative angle between the wind and the ventilator.

Keeping Equation 9 in mind, it will be clear that the equivalent system representing the ventilation and suction pipe will be as given in Fig. 3. Here K_1 is the inlet resistance, K_p is the suction pipe resistance between points (1) and (2) and K_v is the ventilator resistance. The pressure at (2) will be given by

$$\Delta P_2 - \Delta P_1 = K_p\ \tfrac{1}{2}\ \rho_1 v_w^2 \ \ldots\ (11)$$

Similarly

$$\Delta P_3 - \Delta P_2 = K_v\ \tfrac{1}{2}\ \rho_1 v_w^2 \ \ldots\ (12)$$

where

ΔP_1, ΔP_2 and ΔP_3 = depressions at points (1), (2) and (3) respectively.

Dividing Equation 12 by the wind velocity head $\tfrac{1}{2}\rho_0 V^2$, gives:

$$(\Delta P_3/\tfrac{1}{2}\ \rho_0 V^2) - (\Delta P_1/\tfrac{1}{2}\ \rho_0 V^2) = \eta + K_v\ \psi^2\ \rho_1/\rho_0 \ \ldots\ldots\ldots\ldots\ (13)$$

Substituting from Equations 10 and 6, Equation 13 becomes

$$(\Delta P_{inf}/\tfrac{1}{2}\ \rho_0 V^2) - x\ \psi^2\ (\rho_1/\rho_0) = \eta + K_v\ \psi^2\ (\rho_1/\rho_0) + \lambda^2 \ \ldots\ldots\ (14)$$

Now $\Delta P_{int}/\tfrac{1}{2}\rho_o V^2$ represents the maximum value of η, i.e. the value of η when the suction pipe is closed off (infinite resistance). If this value is written as η_{max}, then

$$\eta_{max} = \Delta P_{int}/\tfrac{1}{2}\,\rho_o V^2 \quad \ldots\ldots\ldots\ldots (15)$$

Substituting for λ^2 from Equation 6, Equation 11 becomes:

$$\eta_{max} - \eta = \lambda^2\,[1 + (x + K_v)/(1 + K_i)] \quad \ldots\ldots\ldots\ldots (16)$$

or

$$\lambda^2 = \alpha\,(\eta_{max} - \eta) \quad \ldots\ldots\ldots\ldots (17)$$

where

α = a constant depending only upon the relative angle between the wind and the ventilator.

Comparing this equation with Equation 7 it is seen to differ from that of Schrenk in that the relation between λ and η is parabolic instead of linear, a relation which would satisfy the requirements of turbulent flow more satisfactorily. The graphical representation of Equation 17 would be the same as that depicted in Fig. 2 for Schrenk's relation, providing the ordinate axis is taken as λ^2 instead of λ. Hence the remarks concerning the method of correcting to free inlet conditions as regards Schrenk's equation also applies to Equation 17. However, since in Equation 17 the value of the constant α is known in terms of quantities which are separately measurable, this equation allows for the calculation of the performance at any value of the suction pipe resistance.

In this connection, consider Equation 11. Dividing by $\tfrac{1}{2}\rho_o V^2$ and substituting for η gives:

$$\eta = K_p\,(\tfrac{1}{2}\rho_i v_w^2/\tfrac{1}{2}\rho_o V^2) = (\rho_i/\rho_o)\,K_p\psi^2$$

Substituting this expression, together with Equation 6 into Equation 16 yields:

$$\psi^2 = [\eta_{max}\,(\rho_o/\rho_i)]/[1 + x + K_i + K_p + K_v]$$

and it follows, since the density is inversely proportional to the absolute temperature, that

$$\psi^2 = [\eta_{max}\,(T_i/T_o)]/[1 + x + K_i + K_p + K_v] \quad \ldots\ldots\ldots\ldots (18)$$

where

T_o = temperature of air (absolute scale) outside the building.

T_i = temperature of air in the suction pipe.

If $K_i + K_p$, the total suction pipe resistance, is denoted by K, Equation 18 becomes

$$\psi^2 = [\eta_{max}\,(T_i/T_o)]/[1 + x + K + K_v] \quad \ldots\ldots\ldots\ldots (19)$$

By performing tests (one with an open and another with a closed suction pipe), the value of the constant α in Equation 17 may be found, this constant being equal to

$$\alpha = 1/[1 + (x + K_v)/(1 + K_i)] \quad \ldots\ldots\ldots\ldots (20)$$

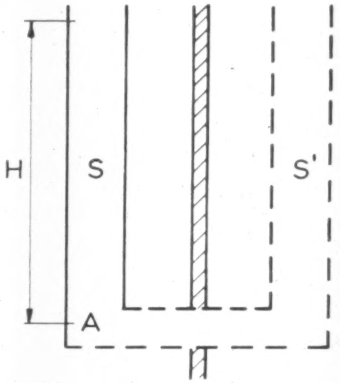


Fig. 4 — Diagram illustrating stack effect

K_i and K_v be determined separately, so that x may be found. Substituting x and K_v into Equation 19 and assuming, as is the case under test conditions, that $T_o = T_i$, a relation between the flow coefficient ψ and the suction pipe resistance K is obtained, from which the airspeed in the suction pipe can be calculated for any value of K and V. In particular, for free inlet conditions $K = 0$ and

$$\psi^2 = [\eta_{max}\,(T_i/T_o)]/[1 + x + K_v] \quad \ldots\ldots\ldots\ldots (21)$$

where

ψ_o is the flow coefficient for free inlet conditions.

Since $\psi = v_w/V$, the air velocity in the suction pipe is given by

$$v_w = V\sqrt{[\eta_{max}(T_i/T_o)]/[1 + x + K + K_v]} \quad \ldots\ldots\ldots\ldots (22)$$

The extraction, in cubic feet per minute of air at a temperature T_i, is given by

$$Q_w = 88AVC_t\sqrt{\eta_{max}}/(1 + x + K + K_v) \quad \ldots\ldots\ldots\ldots (23)$$

where

V = miles per hour.

A = cross-sectional area of ventilator stack (assumed same as that of suction pipe).

C_t = temperature correction factor = $\sqrt{T_i/T_o}$.

Defining standard air conditions as dry air at a temperature of 70 F and a barometric pressure of 760 mm mercury, the extraction in cubic feet per minute of standard air is given by

$$Q_{w\,(standard)} = 88AVC_tC_s\sqrt{\eta_{max}}/(1 + x + K + K_v) \quad \ldots\ldots\ldots\ldots (24)$$

where

$$C_s = (530/760)\,(B/T_i) = 0.697\,(B/T_i) \quad \ldots\ldots\ldots\ldots (25)$$

B being the barometric pressure in millimeters mercury.

For ordinary purposes the temperature correcting factor C_t may usually be taken as unity.

Stack Effect: A formula for estimating the magnitude of the stack effect will now be derived. Consider a stack of height H (ft) in which the air temperature has the average value of T_i in F, absolute, and let S' be an identical column of air outside the building in which the average air temperature is T_oF, absolute (see Fig. 4). If T_i is greater than T_o, the column S' will, provided S and S' are interconnected at the bottom, cause the air in S to move upwards. The pressure at A causing this movement is due to the difference in weight between the 2 columns, and will be equal to

$$h_t = H\,(W_o - W_i)\ \text{lb/sq ft} \quad \ldots\ldots (26)$$

where

W_o = density of air, pounds per cubic foot at temperature T_o.

W_i = density of air, pounds per cubic foot at temperature T_i.

Now the density of air, in slugs per cubic foot at a temperature T and a barometric pressure B (mm mercury) is given by

$$\rho = 0.001625\,B/T$$

so that

$$W = 0.001625\,B/Tg$$

Substitute for W_o and W_i in Equation 26, and

$$h_t = H \times 0.001625gB[(1/T_o) - (1/T_i)]\ \text{lb/sq ft} \quad \ldots\ldots\ldots\ldots (27)$$

Let v_s be the air velocity (fps) in the stack, K_t the total stack resistance factor and ρ_i the density, in slugs per cu ft, of the air in the stack. Then the pressure head necessary to set up the velocity head $\frac{1}{2}\rho_i v_s^2$ plus that required to overcome the friction head $K_t \frac{1}{2}\rho_i v_s^2$, is equal to

$$h_s = (1 + K_t)\ \tfrac{1}{2}\rho_i v_s^2 \quad \text{........(28a)}$$
$$= (1 + K_t)\ \tfrac{1}{2} \times 0.001625\ (B/T_i)\ v_s^2 \quad \text{..............................(28)}$$

If flow is provided only by the stack effect, then $h_t = h_s$, and it follows from Equations 27 and 28 that

$$v_s = [2Hg/(1 + K_t)]^{1/2}\ [(T_i/T_o) - 1]^{1/2}, \text{ fps.}$$

The flow Q_s, in cfm of air at temperature T_i is given by

$$Q_s = 60A\ [2Hg/(1 + K_t)]^{1/2}\ [(T_i/T_o) - 1]^{1/2} \quad \text{......(29)}$$

where

A = the area, in square feet, of the suction pipe.

Substituting for g:

$$Q_s = 482A\ [H/(1 + K_t)]^{1/2}\ [(T_i/T_o) - 1]^{1/2}$$

and since

$$K_t = K + K_v$$

$$Q_s = 482A\ [H/(1 + K + K_v)]^{1/2}\ [(T_i/T_o) - 1]^{1/2} \quad \text{......(30)}$$

The extraction, in cfm of standard air, is given by

$$Q_s\ (_{\text{standard}}) \doteq 482AC_s\ [H/(1 + K + K_v)]^{1/2}\ [(T_i/T_o) - 1]^{1/2} \quad \text{............(31)}$$

Forced Draft Effect: As mentioned earlier, this effect depends upon the existence of a pressure difference between the interior of a building and the region over the roof. If this pressure difference h_f is known, the extraction due to the forced draft may readily be calculated from a knowledge of the ventilator resistance. Thus

$$h_f = (1 + K + K_v)\tfrac{1}{2}\rho_i v_f^2 \quad \text{....(32)}$$

where

$\frac{1}{2}\rho_i v_f^2$ = average velocity head in suction pipe.

Substituting for ρ_i in terms of the temperature T_i and the barometric pressure B, and expressing h_f in mm water, the extraction in cfm of air at temperature T_i is given by

$$Q_f = 0.952\ [h_f/(1 + K + K_v)]^{1/2}\ [T_i/B]^{1/2} \quad \text{...............(33)}$$

The extraction in cfm of standard air is equal to

$$Q_f\ (_{\text{standard}}) = 0.952\ C_s\ [h_f/(1 + K + K_v)]^{1/2}\ [T_i/B]^{1/2} \quad \text{..................(34)}$$

Combined Effects of Wind and Temperature: To calculate total flow when the stack effect acts in combination with the aspiration and forced draft effects, consider Equation 10.

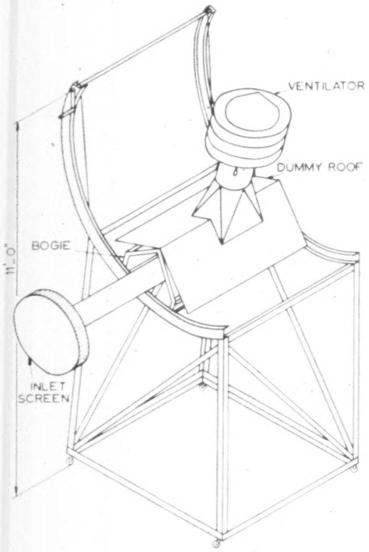


Fig. 5 — Test rig for mounting roof ventilator in wind tunnel

$$\text{i.e. } \Delta P_3 \doteq \Delta P_{\text{inf}} - x\tfrac{1}{2}\rho_i v_w^2$$

since

$$\eta_{\max} = \Delta P/\tfrac{1}{2}\rho_o V^2 \text{ and } \psi = (v_w^2/V^2)(\rho_i/\rho_o), \text{ it follows that}$$

$$\Delta P_3 = (\eta_{\max} - x\psi^2)\ \tfrac{1}{2}\rho_o V^2$$
$$= \{\eta_{\max} - [x\eta_{\max}/(1 + x + K + K_v)]\}\ \tfrac{1}{2}\rho_o V^2, \text{ from Equation 19.}$$

When an additional head $h_s + h_f$ is set up, then the depression causing the flow is $\Delta P'_3$, where

$$\Delta P'_3 = \Delta P_3 + h_s + h_f$$

and the total velocity of flow v_{tot}, is given by

$$\tfrac{1}{2}\rho_i v_{\text{tot}}^2 = \Delta P'_3/(1 + K + K_v) = [\eta_{\max}/(1 + x + K + K_v)]\ (\tfrac{1}{2}\rho_o V^2) + [h_s/(1 + K + K_v)] + [h_f/(1 + K + K)]$$

$$v_{\text{tot}}^2 = \rho_o/\rho_i\ [\eta_{\max}/(1 + x + K + K_v)]V^2 + [2h_s/\rho_i(1 + K + K_v)] + [2h_f/\rho_i(1 + K + K_v)] = v_w^2 + v_s^2 + v_f^2$$

from Equations 19, 28*a* and 32. Therefore

$$Q_{\text{tot}} = \sqrt{(Q_w^2 + Q_s^2 + Q_f^2)}, \text{ cfm of air at temperature } T_i \quad \text{..(36)}$$

The total extraction in cfm of standard air is given by

$$Q_{\text{tot}}\ (_{\text{standard}}) = C_s\sqrt{(Q_w^2 + Q_s^2 + Q_f^2)} \quad \text{.............(37)}$$

where Q_w, Q_s, Q_f are given respectively by Equations 23, 30 and 33.

If, as has been found in the case of low-pitched roofs[1], the ventilator is situated within a stagnant zone (*i.e.* a region of no flow), then the aspiration effect is absent, and the forced draft head, h_f, is equal to the difference in static pressure inside the building, and that prevailing within the stagnant zone. As mentioned before, these pressures depend upon the building shape and orientation, and must be determined by field or model tests.

Experimental Equipment

To prove the validity of the theory underlying the method of correcting to free inlet conditions, tests were performed on a typical 12-in. roof ventilator, the tests being conducted in a 10-ft open jet wind tunnel in which the airspeed was variable in the range 5 fps to 30 fps. To provide for testing at different values of the relative angle between the wind and the ventilator, a test rig was designed (see Fig. 5) which supported the ventilator at the correct height in the tunnel working section, and which allowed for tilting the ventilator at various angles to the horizontal. The ventilator, together with its suction pipe, was attached to a bogie moving on 2 parallel curved rails, allowing the relative angle between wind and ventilator to be varied from 0 to 90 deg, this range being extended a further 90 deg by rotating the entire rig horizontally through 180 deg. Adjustment of the bogie position was obtained by a manually operated hoist arrangement which could be locked by a pawl and ratchet.

To approach the manner in which roof ventilators are mounted in practice as closely as possible, a dummy roof (5 ft square when flat) of variable-pitch was provided between the bogie and the ventilator stack. The pitch of the dummy roof was, in this case, fixed at 20 deg to accommodate the ventilator stack adaptor.

The suction pipe consisted of a circular duct connected through a 90 deg elbow to the ventilator stack (see Fig. 6), the elbow being of square section and incorporating 5 sheet metal corner vanes. To provide smooth entrance conditions, the suction pipe inlet was provided with a suitable bell mouth.

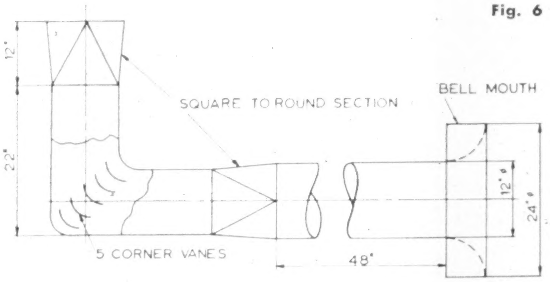


Fig. 6 — Suction pipe

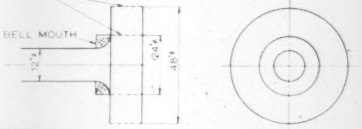


Fig. 7 — Inlet screen

Experience with previous tests in the wind tunnel indicated that random disturbance effects could be expected in the *still air* region of the working section, and it was feared that such disturbances acting in the vicinity of the suction pipe inlet would result in a ventilator action opposing the main flow. To avoid this, the inlet to the suction pipe was provided with a screen, and the most suitable design is depicted in Fig. 7. It consisted essentially of 2 concentric rings of resistance material fitted co-axially to the end of the bell mouth, the open ends being closed off by means of hardboard discs. Thus it was expected that any disturbance penetrating through the first ring, would be damped out in the annulus between the 2 rings. A satisfactory resistance material was found to be perforated sheeting, the perforations being of 1/8-in. diameter at a 3/16-in. pitch.

Static tappings were provided in the suction pipe at positions immediately inside the inlet and downstream of the elbow, these positions corresponding respectively to (1) and (2) in Fig. 1. The tappings consisted of 1 mm holes spaced radially at equal distances round the circumference of the duct.

Verification of Theory

The first assumption to be tested was the one postulating that static pressures in the suction pipe are proportional to the wind dynamic pressure, this being equivalent, in effect to the statement that the airspeed in the suction pipe is directly proportional to the windspeed. Measurement of ΔP_1, and ΔP_2, the static depressions at positions (1) and (2) (Fig. 1), were made at different values of the windspeed, the windspeed being measured by Pitot-static tube and all pressure differences by projection manometers. The tests were repeated for values of Θ, the wind incidence, between −20 deg and 53 deg, the sign convention being chosen so that an incidence of +90 deg refers to a wind blowing vertically down into the ventilator stack. The results are plotted in Figs. 8, 9 and 10, and the relation was consistently linear. Thus the assumption was justified and the parameters $\Delta P_1/\frac{1}{2}\rho_o V^2$ and $\Delta P_2/\frac{1}{2}\rho_o V^2$ could be considered as constant and dependent only upon the ventilator orientation and suction pipe resistance. It must, however, be specified that the constancy of these parameters cannot be guaranteed for values of the windspeed lower than 2 to 3 mph., in which range the flow might no longer be fully turbulent.

The validity of the theoretically derived equation

$$\lambda^2 = \alpha\ (\eta_{\max} - \eta)$$

as opposed to Schrenks relation, which has the form

$$\lambda = \alpha\ (\eta_{\max} - \eta)$$

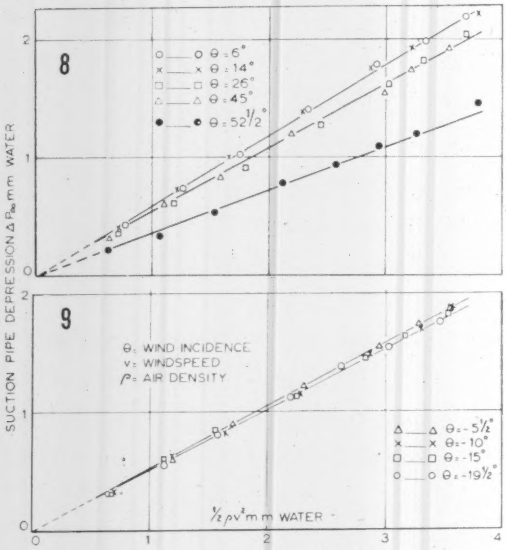
was tested by determining the values of λ, η and $\eta_{\max}$ at different values of the suction pipe resistance, $\eta_{\max}$ being obtained by closing off the entrance to the suction pipe. The resistance was varied by introducing wire gauzes of different mesh into the suction pipe.

The results are plotted in Figs. 11, 12 and 13. The values of λ, η and $\eta_{\max}$ were calculated from the slopes of these lines, and the curves of λ against η are plotted for Θ = 0 deg in Fig. 14, and for Θ = 18 deg in Fig. 15. These curves indicate that the theoretical form of the equation agrees better with the experimental results than does Schrenk's version, and it was concluded that more accurate free inlet corrections would be obtained by the use of the theoretical equation. This equation allows for the prediction of the performance at any value of the suction pipe resistance, thus making it possible to calculate the extraction for the case where an extension is attached to the ventilator stack.

Performance Testing of a Typical Roof Ventilator

To ascertain the practibility of the proposed test method a trial test was carried out on a typical 12-in. roof ventilator.

If it is required only to evaluate the aspiration effect it would suffice to determine experimentally the value of the inlet resistance K_i (which amounts to a calibration of the suction pipe depression in terms of the airspeed), and the values of the parameters $\eta_{\max}$ and α over a range of wind directions. Thus, since K_i is known, the values of $(x+K_v)$ over the range of wind directions may be found from Equation 20, which, on substitution in Equation 19 yields the corresponding values of ψ. It is clear, therefore, that x and K_v need not be known separately.



Figs. 8 and 9 (*left*) — Suction pipe depression for infinite suction pipe resistance

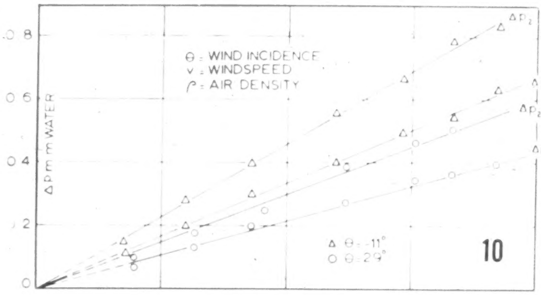


Fig. 10 (*right, above*) — Suction pipe depression — no additional resistance in suction pipe

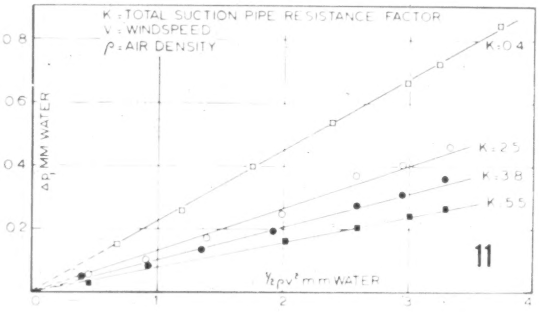


Fig. 11 (*right, below*) — Suction pipe depression $\triangle P_1$ for different values of the suction pipe resistance. Relative angle between wind and ventilation = 0 deg

However, if it is also required to calculate the stack and forced draft effects, then K_v has to be known explicitly (see Equations 30 and 33). Thus to obtain all the ventilator characteristics, the following experimental procedure is necessary: (*a*) Determination of K_i, the inlet resistance; (*b*) Determination of K_v, the ventilator resistance; and (*c*) Determination of λ, η and $\eta_{\max}$ over a range of wind directions.

If interest is restricted to the aspiration effect (for instance when ventilators are merely to be compared), then step (*b*) is eliminated.

(*a*) *Inlet Resistance*: The set-up by means of which K_i was determined is shown in Fig. 16. The 7-deg diffusor was provided with splitters to minimize the effect of possible swirl. Control of the airspeed was obtained by mechanically adjusting the speed ratio between motor and fan, and by introducing various resistances on the outlet side of the fan, this arrangement allowing the airspeed in the suction pipe to be variable within the range zero to 17 fps. ΔP_1 was measured at a position 2-in. inside the inlet to the suction pipe, the use of 4 symmetrically spaced tappings in the duct wall allowing an average value of the static depression at the section of the duct to be obtained.

The graph of ΔP_1 against $\frac{1}{2}\rho V^2$, the suction pipe velocity head, obtained by systematically varying the airspeed, is plotted in Fig. 17, and is seen to be a straight line.

Now, according to Bernoulli

$$\Delta P_1 = (1 + K_i)\tfrac{1}{2}\rho V^2$$

so that

$$K_i = (\Delta p_1/\tfrac{1}{2}\rho V^2) - 1$$

Therefore, since $\Delta P_1/\frac{1}{2}\rho V^2$, as obtained from Fig. 17, is constant, K_i must be constant. Thus it was found that an airspeed of about 2 fps in the suction pipe yielded a depression of about 0.022 m water, which could be measured to within 10 percent by a manometer. However, as will be noted later, the testing of a ventilator requires measurements only at high values of the windspeed, the theory allowing for extrapolation to any other condition. Thus measurements may be obtained with greater accuracy and, in general, it is expected that the results obtained by use of the foregoing method of airspeed measurement, will be accurate to within about 5 percent.

(*b*) *Ventilator Resistance*: The apparatus used for obtaining the ventilator resistance is shown diagrammatically in Fig. 18, and consisted of a 12-in. duct connecting the outlet of a 12-in. axial flow fan to the ventilator stack. The flow was measured by the standard orifice plate, and a ring of 4 symmetrically spaced static tappings as shown. This allowed the pressure loss ΔP over the ventilator to be measured in terms of the airspeed, v. K_v was calculated from the relation.

$$\Delta P = (K_v - 1)\tfrac{1}{2}\rho v^2$$

(*c*) *Performance Tests*: The performance tests amounted to finding the values of the parameters λ, η and $\eta_{\max}$ at different values of the wind direction, using the experimental equipment just described.

By virtue of the constancy of the parameters $\Delta P_1/\frac{1}{2}\rho_0 V^2$, $\Delta P_2/\frac{1}{2}\rho_0 V^2$ and $\Delta P_{\text{int}}/\frac{1}{2}\rho_0 V^2$, it was sufficient to take measurements at only one value of the windspeed, this speed being chosen high enough (about 25 fps) to provide for accurate measurements of pressures. To ensure accuracy each pressure measurement was taken as the average of 10 readings, the observations being repeated, in doubtful cases, at different values

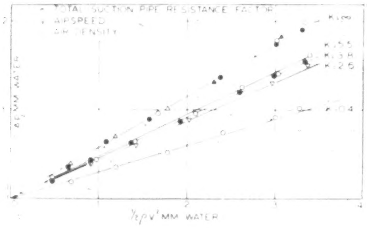


Fig. 12 — Suction pipe depression $\triangle P_2$ for different values of the suction pipe resistance. Relative angle between wind and ventilator = 0 deg

of the windspeed. The tests were performed over a range of wind directions from −20 to 67 deg, the higher value representing that angle where the flow through the suction pipe was reversed. Thus, the parameters $\Delta P_i/\frac{1}{2}\rho_0 V^2$ and $\Delta P_2/\frac{1}{2}\rho_0 V^2$ and $\Delta P_{inf}/\frac{1}{2}\rho_0 V^2$ were obtained, and are plotted against Θ in Fig. 19.

Calculations and Presentation of Results

From Fig. 19 the parameters λ, η and η_{max} could be determined which, on substitution in Equation 17 allowed the values of α to be calculated over the range of values of Θ. Further, since K_v and K_i were known, the corresponding values of x could be calculated from Equation 20.

The 2 characteristic parameters x and η_{max} are plotted in Fig. 20, from which, on substitution in Equation 23, the volumetric flow Q_w may be calculated for any values of the windspeed, wind direction, suction pipe resistance and temperature ratio. The results as calculated with the use of Fig 20 may be more conveniently presented in the form of a chart, as given in Fig. 21, from which Q_w may be directly read off for any required conditions. An example indicating the use of this chart is given on Fig. 21. The extraction as obtained from the chart is given for the conditions where $T_i = T_o$. If there should be a temperature difference, Q has to be multiplied by the temperature correction factor C_t. In order to obtain the extraction in cfm of standard air, Q has to be multiplied by C_tC_s (see Equation 25).

The stack effect and forced draft effect may be calculated by the use of Equations 30 and 33 respectively, and the combined flow by means of Equation 36.

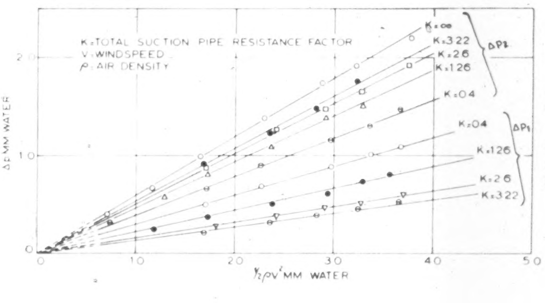
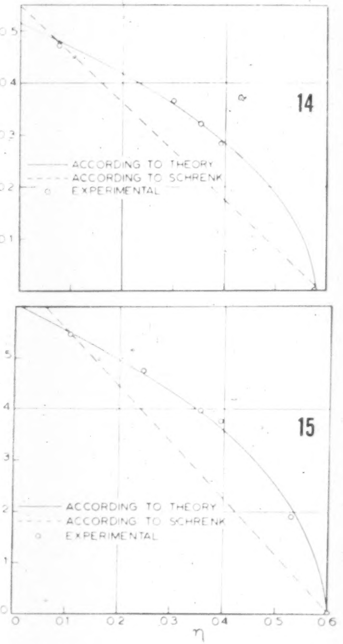


Fig. 13 — Suction pipe depressions $\triangle P_1$ and $\triangle P_2$ for different values of the suction pipe resistance. Relative angle between wind and ventilator = 18 deg



Figs. 14 and 15 — Relation between flow and pressure coefficients for a relative angle between the wind and ventilator of 0 deg in Fig. 14; and 18 deg in Fig. 15

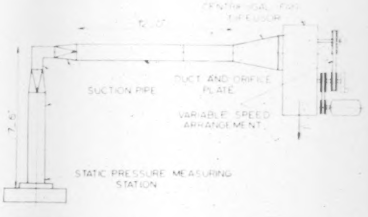


Fig. 16 — Apparatus for determining suction pipe inlet resistance (K_i)

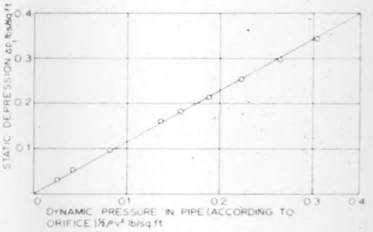


Fig. 17 — Calibration of static depression $\triangle P_1$, in terms of airspeed in suction pipe

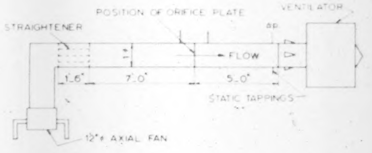


Fig. 18 — Apparatus for determining ventilator resistance

Comparative Rating of Ventilators

As mentioned before, the aspiration effect, being the only effect which depends primarily upon the shape and construction of the ventilator, constitutes a convenient basis for comparative rating of ventilators. Since the aspiration effect is characterized by the flow coefficient ψ, and since from Fig. 21, the flow coefficient varies considerably with the wind direction, it is suggested that an average value of ψ (at free inlet) be employed for the purpose of comparison. The range of Θ over which ψ is averaged should, however, be the same for all the ventilators which are to be compared. Averaging ψ over the range from −20 to 67 deg a value of approximately 0.4 is obtained for the ventilator of which the performance curves are given in Fig. 21. This number might be termed the characteristic flow coefficient in the range −20 to 67 deg, and is the value which should be employed when information regarding the wind conditions at the ventilator head is inadequate. The corresponding average extraction for this ventilator under free inlet conditions amounts, to about 28 cfm per unit velocity (mph) of the free windstream.

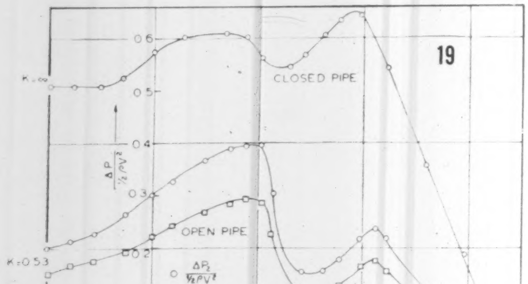


Fig. 19 (*left*) — Experimental results obtained for a typical 12-in. roof ventilator

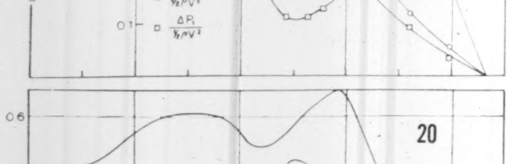
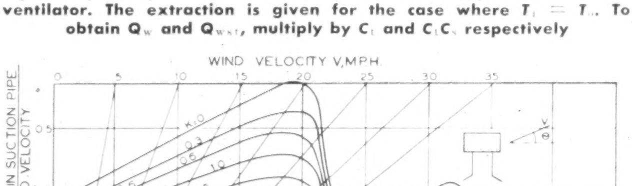


Fig. 20 (*left, below*) — Characteristic parameters x and η_{max} for a typical 12-in. roof ventilator

Fig. 21 (*below*) — Performance curves for a typical 12-in. roof ventilator. The extraction is given for the case where $T_i = T_o$. To obtain Q_w and Q_{wst}, multiply by C_t and C_tC_s respectively



Conclusions

1. The theory here developed yields closer agreement with the experimental results than does Schrenk's relation. In addition to allowing for the extrapolation of test results to free inlet conditions, this theory provides a method whereby the performance may be calculated at any given value of the suction pipe resistance, and which allows for the estimation of the extraction when an extension is made to the ventilator stack.

2. For windspeeds above about 2 to 3 fps the relationship between the static pressure in the suction pipe and the wind velocity head is linear. This reduces the labor involved in the test procedure, since all parameters having the form $\Delta P/\frac{1}{2}\rho_o V^2$ may be determined at only one value of the windspeed.

3. Separate determination of the ventilator resistance becomes necessary only when the stack and forced draft effects are to be evaluated.

4. Experimental determination of the magnitude of the forced draft effect is rendered impractical by its dependence on irreproducible factors such as the shape and location of the building, and the number and size of openings. This effect may, however, be evaluated theoretically if the static pressure within the building in the vicinity of the ventilator stack inlet is known.

5. Since ventilator performance is sensitive to changes in the local windspeed and direction, an accurate prediction of the extraction can be made only from a knowledge of the conditions at the ventilator site. These conditions are not necessarily the same as those in the free windstream[1], and sufficient information regarding them can be obtained only from field tests on the building or from model tests. If, however, an estimate of the ventilator performance is to be based on the free stream wind velocity, it is suggested that this velocity be employed in conjunction with the average value of the flow coefficient, the average being taken over a range of wind directions.

6. This average flow coefficient, which gives an estimate of the average magnitude of the aspiration effect, may be used as a convenient basis for comparative rating of ventilators.

7. It is estimated that the experimental procedure outlined would yield results accurate to within about 5 percent.

Acknowledgment

The author is indebted to the South African Council for Scientific and Industrial Research for permission to publish this paper.

References

1. Wind Tunnel Tests on Scale Model Buildings as a Means for Studying Ventilation and Allied Problems, by J. J. Wannenburg and J. F. van Straaten (To be published).

2. Experimental Studies in Natural Ventilation, by J. B. Dick (*Journal Inst. Heating and Ventilating Engrs.*, Vol. 17, No. 173, Dec. 1949).

3. Untersuchhungen von Dachluftern, by O. Schrenk (*Ergebnisse der Aerodynamischen Versuchsanstalt Gottingen*, 4 Lieferung, Munchen - Berlin 1932).

4. Die Naturliche Raumentluftung Mittels Einzelund Flachenentlufter, by Otto Conrad (*Zeitschrift des Verein Deutscher Ing.*, Vol. 95, No. 17/18, June 1953).

From '36 to '56: Air Conditioning Comes of Age

By Walter A. Grant*, Syracuse, N. Y.

Since this paper is historical in character it is being presented in the Journal Section in 3 parts, of which this is the last. Here the author turns attention to the developments of the last 2 decades in connection with air-conditioning systems. He also looks at the future horizons of air conditioning.

Air-Conditioning Systems

No examination of air-conditioning progress would be complete without a review of the systems which have resulted from the application of our basic knowledge and array of modern products.

Residential Systems: During the past 5 years, the rapid acceptance of residential air conditioning has opened up new horizons in the design of central plant self-contained air conditioners. Residence application is quite different from commercial, for the equipment is concealed and may be located in the basement, garage, utility closet, attic, or outdoors. With a volume market in prospect, manufacturers have designed packages specifically applicable to each of these locations. The trend toward air cooling with its need for location near a source of outside air has given rise to the 2-package or 3-package air-conditioning plant. Space does not permit listing the different combinations of packages now available. All fall into the class of either all-year or summer conversion equipment.

The all-year package is designed primarily for new construction or where the existing heating system is to be replaced. It is usually located in the basement or in the utility closet, and may be served by a cooling tower, or may have a separate air-cooled condenser package.

The add-on conversion cooling unit is designed specifically for addition to an existing heating system, but it is also frequently used in new construction. Here the trend is toward remote location, frequently outdoors, with only the cooling coil (and fan if required) located near the furnace.

Most of these types employ direct expansion cooling. However, there are also available self-contained water chillers which may be located outdoors with suitable freezing protection. This equipment may be advantageous in conditioning homes supplied with wet heat, by substituting suitable fan coil units for existing radiation. Smaller houses with wet heat are often cooled successfully by direct expansion units in the attic.

The importance of the room air conditioner in the residential market has already been noted. But it is proving to be a calling card, a preview of the benefits which air conditioning can bring into an entire home. More often that not, the best and most economical solution proves to be a central system.

The heat pump, too, has been described in the section devoted to equipment. It may yet have a unique place in the home, but it has to justify its glamour through solid performance and demonstrated superiority in the face of higher investment and operating costs.

Finally, the gas utility industry has at long last recognized the challenge of the electric heat pump and the all-electric home. It is sponsoring strong research and development programs designed to make equipment burning gas as much an economic factor in residential cooling as it has been in heating. The all-year absorption unit has been available to the home market for many years. Now in the past 2 years have appeared compression units powered by natural gas-driven internal combustion engines, and field samples of new types of fuel-operated cooling cycles. Truly the art is moving faster with every passing day.

A relatively recent market lies in mobile homes (house trailers), where the obvious first approach was to apply standard room air conditioners. Space and arrangement problems proved this course a makeshift, and special-purpose units are now available.

Commercial Systems: Perhaps the most important single system developed during the past 2 decades is the high-velocity system, engineered to overcome the problems of multi-room air conditioning. It was created from sheer economic necessity. The costs of constructing multi-story, multi-room buildings have risen to a point where space conservation for service functions is a major consideration. Moreover, maintenance costs have risen to a point where owners are hypersensitive about overhead.

The conventional air-conditioning solution to the problems posed by this type of building involved a central air-conditioning apparatus which propelled large volumes of conditioned air into each room at low velocities through big supply ducts. More ducts, equally large, were required for air return. This straightforward engineering approach produced acceptable results, but sacrificed valuable floor space, headroom, and shaft area.

Unlike theaters or department stores, multi-room buildings, such as office buildings, apartments, hospitals and hotels, have a high percentage of outside rooms, with shifting solar heat gain as much as 60 percent of the total sensible load, and internal load varying from room to room with lighting and occupancy. The conditions maintained by a single zone temperature controller, perfectly acceptable in a large space such as a theater, were often unacceptable in multi-room buildings where some rooms required heating and others cooling. Also, individual control by the occupant was fast becoming a basic requirement. The solution of this problem by Willis H. Carrier in 1937 embodied an entirely new approach. It did not attempt to circulate all of the air required for cooling, but only that minimum necessary for ventilation. Rather than processing 100 percent of the air circulated in the building, his conduit induction system preconditioned only that 25 percent represented by the ventilation air, and utilized it as the motive power to induce secondary air over coils in the induction units located in each individual room.

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Presented at the 63rd Annual Meeting of the American Society of Heating and Air-Conditioning Engineers, Chicago, February 1957.

Because less than one-fourth of the air was circulated, small conduits were employed to distribute it at velocities of 3000 to 4000 fpm from the central primary air conditioner to the room units. In the latter the primary air passed at high velocity through nozzles inducing room air over the coil supplied with either heated or cooled water, and thence into the room.

This system represented an important milestone, because it fulfilled an urgent economic need — the need to save valuable space. Moreover, this saving was achieved without sacrifice of any important performance objective. Since ventilation, room humidity and circulation were stabilized because of the total absence of dampering devices in the air circuit, individual room temperature control became a practical reality.

The conduit induction system represented the first modern primary air system for multi-room buildings. Other popular variations employed fan coil units in each room to provide the sensible heating or cooling. These systems were functionally identical with the induction system except that a fan replaced the induction nozzles. An inferior but widely used arrangement employed fan coil units without a central primary system.

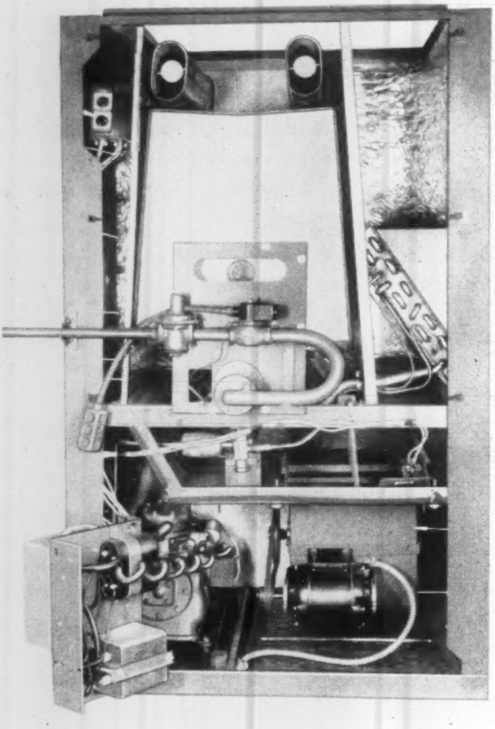


Fig. 26—Interior view of 2-ton central plant unit for the all-year air conditioning of residences, showing functional elements

An innovation of the last 5 years was the dual-duct system, which had been borrowed from schoolhouse practice of 50 years ago, and streamlined to meet the needs of modern multi-room buildings. It required no water piping, but produced its cooling or heating by mixing air from 2 ducts, supplied at different temperature levels. While the cost of water piping was saved, the conduits, even with air at high velocity, were much larger than with the primary air induction system, and therefore fewer floors could be served by each air-conditioning unit. Although it represented a considerable space saving over the conventional low pressure system, the dual-duct system by definition implied variation in air volume at each distributing element, resulting in control complications. Nevertheless, progress has been made in solving the inherent problems of instability, pressure regulation, noise, and air distribution.

In the effort to avoid large ducts, another technique of importance developed in the last 20 years was the distributed unit system, which employed relatively small air-conditioning packages to serve the various zones of a multi-room building. These were normally supplied with chilled water from a central refrigerating plant located in the basement. A more recent trend has been the use of self-contained units within each zone, thereby eliminating the network of chilled water pipes from the central unit. Only cooling tower water need be piped to the units.

Beyond the multi-room systems just described, the advances in system techniques during the past 20 years in conditioning commercial buildings were mainly refinements in design and installation. Prompt advantage was taken of new designs in equipment.

There were 3 important improvements in the air conditioning of theaters and auditoriums. One was better air distribution, particularly in the larger houses, through better engineering and diffuser selection. Another was improved silencing of the air conditioning through better isolation of machinery and sound attenuation in the ductwork. Finally, there was vastly improved operation of equipment by theater management, with less indoor-outdoor temperature contrast. The day of the paper icicles on the marquee had passed, and this indeed was evidence that air conditioning was coming of age.

Small stores and many large ones have taken advantage of vastly improved equipment to make possible space saving and equipment decentralization. In the larger stores, the trend has been away from space-consuming central systems with large shaft and duct areas, toward decentralized units or assemblies hung from the ceiling, located on mezzanines, or placed in the conditioned area but occupying minimum floor area. During the past 5 years there has been a trend toward much higher velocity air distribution for department stores, with consequent space saving, improvement in appearance and, in many cases, lower costs.

Other commercial applications, such as restaurants, banks, monumental buildings, and hotel public spaces, have shown little change in application techniques during the past 2 decades. In many of these buildings the chief problem is the structure itself, rather than the air conditioning, and the approach is necessarily dictated by cost, feasibility of making alterations, and appearance.

Industrial Systems: Air-conditioning techniques for the 200 or more industries that were responsible for creating the original air-conditioning market 30 to 40 years ago had been developed and brought to a considerable degree of perfection prior to the 20-year period under discussion. There have been very few *new* industries into which air conditioning has been introduced in recent years, although certainly many older industries which had received only a slight impact have now become heavy users.

Most technological changes have revolved around improvement in equipment and availability of new methods, plus the great acceptance of comfort air conditioning *per se*. This acceptance has in the past decade motivated many industries to install systems with mechanical refrigeration instead of evaporative cooling. Textiles are a case in point. The specific products and processes required humidity fixed within limits, and temperature was often secondary. However, the only way conditions comfortable for employees could be maintained in these mills during normal summer weather, simultaneous with proper humidity for the product, was through the use of mechanical refrigeration.

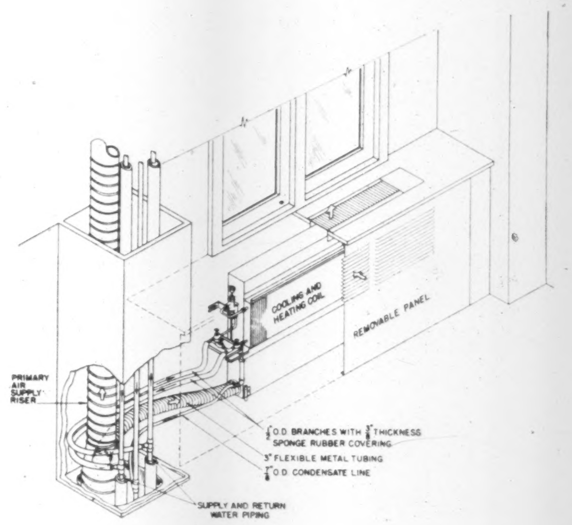

COOLING AND HEATING COIL
REMOVABLE PANEL
PRIMARY AIR SUPPLY RISER
1/2" O.D. BRANCHES WITH 3/8" THICKNESS SPONGE RUBBER COVERING
3" FLEXIBLE METAL TUBING
7/8" O.D. CONDENSATE LINE
SUPPLY AND RETURN WATER PIPING

Fig. 27—Conduit induction unit, showing (left) primary and secondary air flow, and (right) cutaway view from front

While many industrial applications where close humidity control is necessary continued to use large spray humidifiers and dehumidifiers, an increasing number have been buying unitized systems employing smaller building blocks of capacity. As products were perfected with respect to endurance and maintenance, there was less objection to numerous sets of equipment scattered around a plant compared with fewer and larger central systems. This has turned out to be largely an economic problem, involving many factors. The answer is often different for different types of buildings and processes. The number of installations has been increasing using factory or field-assembled complete air-conditioning and refrigeration cycles, ranging from self-contained equipment to units of 75 to 100 horsepower. On the other hand, the operating advantages of plants with large centralized units of water chilling capacity have also been evident.

Marine and Naval Systems: In 1936 the only air conditioning on ocean liners consisted of public rooms such as dining saloons. Since the end of the second World War, nearly every passenger ship commissioned has included air conditioning in all staterooms as well as public rooms, and usually in crew's quarters. In recent years this has also included cargo vessels.

Because of space limitations, marine installations have traditionally employed velocities of 3000 to 4000 fpm. Recent applications have edged up to 5000 fpm with a few reported abroad as high as 7000 fpm.

Frozen food storage requirements have affected the design of cargo conditioning rooms. In 1936, cargo vessels typically used 15 F, but today zero and −10 are not uncommon. Also there is a marked trend to direct expansion systems, although brine is still used. In 1936 precooling of cargo in a dockside warehouse was conventional practice. Since the war there has been a shift to the *hot* cargo method, which requires larger equipment but avoids precooling altogether. Finally, there has been a trend toward temperature control of each individual space. Manual control of brine flow has given way to automatic temperature control.

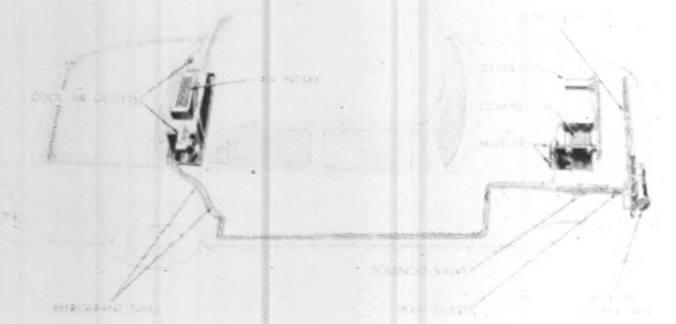


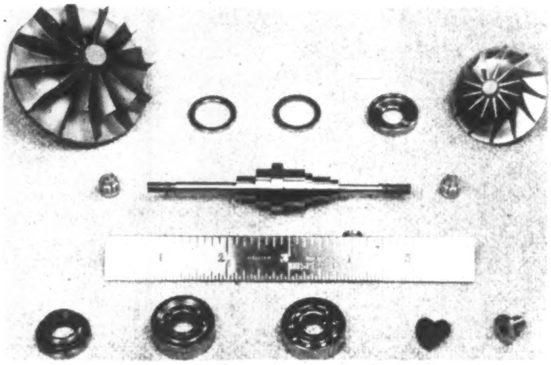
Fig. 28—Factory installed automobile air-conditioning system in a 1956 model, showing compressor belt-driven from main engine, cooling coil back of rear seat

The first application of air conditioning to naval ships in this country was aboard submarines in 1933, both for comfort and to assure proper operation of the electronic equipment. But it was not until the advent of World War II, when surface vessels became compartmented and the quantities of fire-control and heat-producing equipment vastly increased, that air conditioning came into general use within those spaces.

The South Pacific engagements proved that it was necessary to install air conditioning in crew quarters, since without it as many as 10 percent of the crew were immobilized by the effects of high temperature and humidity. The other spaces usually conditioned included aviators' ready rooms, combat information centers, fire-control rooms, steering engine rooms and sick bay areas.

Automotive Vehicles: The 2 major problems in automotive air conditioning have been space and drive. Inter-city buses began to use air conditioning in 1938 with a system capacity of about 4 tons. High speed aluminum reciprocating compressors have replaced belt-driven cast-iron units, and recently aluminum coils have started to replace copper. Most frequently, compressor and condenser fan have been driven by a separate gasoline engine rather than from the bus engine, permitting the capacity of the system to be independent of vehicle speed, but adding to the cost.

Fig. 29—Functional components of 15-ton turbo-compressor for aircraft cabin cooling. Compressed air-driven turbine wheel is at left, refrigerant-12 compressor wheel at right. Note 6-in. scale



Development of automobile air conditioning has been retarded by the drive problem. So far all systems have employed some type of power take-off from the engine, and have run up against the well-known problem of obtaining adequate capacity at all vehicle speeds from idling to 100 mph. One recent design has integrated the cooling equipment under the hood with the car heater. Many early and current designs placed the cooling equipment in a separate compartment in the trunk or behind the back seat.

Railway Passenger Cars: During the thirties, several thousand reciprocating compression, steam ejector, and ice-melting systems were installed. Both of the latter have now been superseded by the lighter and less costly reciprocating system, powered by storage batteries charged from an axle-driven generator. For a number of years, many Pullman cars employed compressors driven from the car axle through a special eddy-current clutch, but this system was abandoned because of excessive power required at high speeds.

With the development of the dome observation car, air-conditioning capacities rose from 8 to as high as 16 tons. Since the power required was greater than is practical from axle-driven generators, diesel engine driven alternators up to 40 kw capacity supply power for both the air conditioning and the lighting loads. With some of the new low center of gravity trains of the Talgo type, all power is supplied from a head-end diesel engine-driven alternator. This permits the use of self-contained air-conditioning units on each car with electric-driven hermetic compressor.

There have been no radical changes in air distribution systems on cars since 1936. In the older cars, the supply ducts were mounted on the roof outside of the car. In the newer cars, the duct is mounted above a false ceiling.

Aircraft: During the war, AiResearch developed the first air cycle refrigeration system for aircraft cabin cooling to rigid requirements of operating conditions and minimum weight and space. The cooling equipment included an ultra-high-speed centrifugal air compressor, an air expansion turbine, an aluminum sandwich-type air-to-air heat exchanger, and special controls integrated with cabin heating and pressurization. This type of equipment has since achieved wide use in both military and commercial aircraft.

In the post-war period, electric-driven vapor cycle refrigeration systems first have been installed on a number of commercial airliners. Unlike air cycle, these systems could operate while the plane was on the ground by plugging in a power line. In order to meet space and weight limitations, substantial design modifications were required in conventional reciprocating compressors, evaporators and condensers. The recent advent of turbo-prop and turbo-jet transports has permitted use of turbine engine bleed air as the source of pneumatic power to drive vapor-cycle centrifugal compressors. Weight of the Carrier 15-ton system for the DC-8 is only 150 lb, of which the high speed turbo-compressor unit accounts for less than 10 lb.

Future Horizons

In future years, air conditioning will develop not alone through technical progress in this industry, but even more importantly through the scientific and engineering advances of our whole economy. Let's stop and gaze into the crystal ball. It may be somewhat clouded, but the picture is truly challenging.

The air-conditioning industry itself will evolve along well-known economic patterns. As it becomes more firmly established on the plateau of maturity, manufacturers will become larger and stronger. Competition will accelerate the trend toward integration to reduce manufacturing costs, and the consumer will be the beneficiary.

Manufacturers will achieve greater integration of their product lines for maximum interchangeability. They will make an intensive effort to reduce equipment size, and strong efforts toward miniaturization will surely be seen in the near future. Military requirements for aircraft and missile cooling will inspire much of this. The early steps imply cooling and heating coils designed to transfer much more heat in much less space. Later, tiny centrifugal compressors can be expected whirring away at fantastically high rotative speeds, driven by motors which employ electrical principles still but a gleam in the inventors' eyes. Radically new air-moving devices will feature an absence of noise and moving parts. And ultimately the product will be inexpensive enough through mass production so it will be cheaper to replace it than repair it when it wears out.

In the future, development of the Man Cooler can be visualized carried in the hip pocket like a walkie-talkie, delivering personal cooling at the flick of a switch. As the air-conditioned man of tomorrow walks around in the broiling sun, solar batteries will generate the power to cool the thermoelectric clothing he is wearing.

While the Man Cooler concept may represent an ultimate and eventual extreme, sensational advances can be expected in environmental control much sooner. The improvements today in air cleaning techniques and products are ahead of consumer realization and acceptance. Practical air sterilization methods are at hand, awaiting further development. Smaller and cheaper odor control devices will permit reduction in outside air to the tiny amount needed for oxygen replenishment and CO_2 removal. Production of desirable odors, a form of psychological environment control, may become commonplace.

This leads to all kinds of intriguing possibilties involving the future therapeutic uses of air conditioning. For example, oxygen added to air appears to create a sense of well-being, and properly controlled, may improve man's health. Its medical importance to persons suffering respiratory and functional disorders is common knowledge. Why should oxygen be confined to the oxygen tent and the iron lung?

Environmental control of ions is claimed to produce similar sensations of well-being. Here is a frontier for immediate research, because the development of equipment for producing and controlling ionization has outrun knowledge of the true physiological importance of ions themselves.

Why stop at oxygen and ions? Why shouldn't medical science come up with answers as to what materials can be added to the air which will stop hay fever, work up an appetite, cure a hangover, dry up that cold, or put one in the mood to fill out an income tax return?

Let's look more closely at the 2 great markets of the future — the factory and the home.

Before the close of the next 20 years, most factories, old and new, will be air conditioned. If underground plants come into general use, they will have to be cooled, and if civil defense is the objective, they will need protection against poison gas and radioactive fall-out. Specialized equipment will be needed for spot cooling in hot areas and occupations, and factory employees may often carry their own. More attention will be paid to cancellation by insulation or ventilation of large sources of heat right at the source, whether due to sunshine from the outside, or lights or machinery on the inside.

Air conditioning of homes will continue its strikingly vigorous evolution. Many of the changes will be stimulated by prefabrication, be it of the entire house or of particular building blocks. Integration into a unit services package now seems a possible direction, to include refrigeration, freezer, stove, and hot water heater. And a panel in the outside wall will form the condenser to get rid of the heat from the refrigerating machinery.

Increased development of all forms of transportation air conditioning can be anticipated. Hard-headed business men expect one-third of all new automobiles to be cooled by 1961. Subway cars are being actively estimated right now, despite the technical and economic problems of cooling 200 people crushed together like sardines. In aircraft cooling where space and weight are controlling, the greatest design changes will be higher rotative speeds and more efficient use of lightweight materials. Speeds up to 10,000 rpm appear attainable with reciprocating equipment, much higher with centrifugals and rotaries. Classified work is being pushed on cooling supersonic military aircraft and guided missiles where flight speeds may produce missile skin temperatures up to 800 F. Some authorities believe that aircraft cooling of the future may require up to one-third of the energy produced by the main power plant. And today's bombers carry power plants developing 100,000 hp. This line of thought leads to speculation about space satellites revolving around the earth, and space vehicles to other planets, and these will need some fancy air conditioning indeed.

Turning to the great outdoors, air conditioning will achieve spectacular results both in the city and on the farm. Inflated plastic canopies may be used to suspend conditioned air over baseball and football stadiums, a forerunner of the air-conditioned street and the air-conditioned city. Air-conditioned pigs and chickens will produce more pork and more eggs per pound of feed. Especially in the tropical countries of the world, air conditioning will increase human productivity. And in the more distant future, total climate control might cause the migration of entire populations into today's undesirable regions of the globe.

Much of the future will depend upon the success of scientists and engineers in developing new sources of energy production and new sinks for its disposal. The imminence of new prime movers — gas turbines, free piston engines, hot air engines — should be recognized and their impact on economy and industry assessed. Nuclear and solar energy represent untapped sources today, tremendous in quantity compared to fossil fuels. Their transformation into usable heat and power hold great promise for further extension of both absorption and compression refrigeration cycles for cooling. Their transformation through as yet unknown photo-chemical, electro-chemical, thermo-electric or nuclear-electric processes would be revolutionary to existing technology.

The near future promises large central heat and power generation from nuclear energy as a certainty. Is it too much of a stretch of the imagination to visualize solar absorbers installed in the roofs of buildings to furnish the energy for heat pumps which supply the heating and cooling? Or to utilize the heat from the molten core of the earth, or the cooling from the icy depths of the ocean?

Well, of course, many of the foregoing projections are sheer flights of fancy, the stuff which dreams are made of. But some of these dreams are going to come true. The majority of them, while a long way off, are being dreamed by our most creative and knowledgeable scientists and engineers. And few of them are more unlikely than the actual facts of the progress of air conditioning during the last 20 years.

Acknowledgment

The author wishes to thank John Everetts, Jr., John E. Haines, and Richard S. Madison for their special contributions, and express his grateful appreciation to James K. Blake, Lee S. Gunlogson, and his many other associates at Carrier who helped him with this paper.

Acknowledgment is also made to those who furnished the following photographs: Fig. 7, Bureau of Mines; Fig. 13, General Electric Co.; Fig. 15, Bryant Mfg. Co.; Fig. 16, Kritzer Radiant Coils, Inc.; Fig. 17, Cleaver-Brooks Co.; Fig. 18, Westinghouse Electric Corp.; Fig. 19, Anemostat Corporation of America; Fig. 20, Barber-Colman Co.; Fig. 23, Copeland Refrigeration Corp.; Figs. 11, 12, 21, 22, 24-27, and 29, Carrier Corporation.

Historical Bibliography

H. P. Oakley, *The first 50 years—a History of the American Society of Refrigerating Engineers* (*ASRE* publ. 1954).

American Practice in Heating, Ventilating and Air Conditioning, by J. K. M. Pryke, (*Journal of the Institution of Heating and Ventilating Engineers*, December 1954, pp. 333-67 — discussion — 367-74).

Air Conditioning has Developed Rapidly, by W. L. Fleisher, (*Heating, Piping & Air Conditioning*, May 1954, pp. 120-22).

Trends in Air Conditioning, by G. R. Winch (*Engineering*, March 12, 1954).

Willis Haviland Carrier, Father of Air Conditioning, by Margaret Ingels (Doubleday & Co., Inc., Garden City, 1952).

How Air Conditioning Has Developed in Fifty Years, by W. L. Fleisher (*Heating, Piping & Air Conditioning*, January 1950, pp. 120-28).

Room Air Conditioners Past and Present, by R. W. Morgan (*Refrigerating Engineering*, Jan. 1950, pp. 34-41).

Dr. Willis H. Carrier, Father of Air Conditioning, by Cloud Wampler, (Newcomen Society of England, American branch publication, 1949; condensed in *Refrigeration*, May 9, 1949).

Air Conditioning, Heat and Ventilating, and Refrigeration (*Proceedings of the Institution of Mechanical Engineers*—War emergency issue No. 33—1947, pp. 355-66. Centenary lectures include: Heating, Ventilation and Air Conditioning, by O. Faber; American Developments in Air Conditioning and Refrigeration During the Last Decade, by W. H. Carrier; Refrigeration—Present and Trends, by S. F. Dorey).

Postwar Air Conditioning Advances, by J. R. Hertzler (*Proceedings Midwest Power Conference*, 1947, pp. 133-37).

Air Conditioning Has Past—and Future! by E. C. Hach (*Industry and Power*, March 1947, pp. 74-75).

Refrigeration and Air Conditioning—in War,—in Peace. (*Air Conditioning and Refrigerating Machinery Association, Inc.*, 1943).

History of the Centrifugal Machine, by W. A. Grant (*Refrigerating Engineering*, February 1942, pp. 82-86, 120, 122).

Air Conditioning Today and Tomorrow, by W. B. Henderson (*Ice and Refrigeration*, December 1938, pp. 403-04).

Economics of Air Conditioning, by A. H. Milnes (*Journal of the Institution of Heating and Ventilating Engineers*, August 1938, pp. 311-19).

Developments in Refrigeration as Applied to Air Conditioning, by R. E. Cherne (*Ice and Refrigeration*, July 1941, pp. 27-32).

Proceedings of Conference on Refrigeration and Air Conditioning (Columbia University, Department of Mechanical Engineering, 1954).

How Air Conditioning Has Advanced Refrigeration, by W. H. Carrier (*Mechanical Engineering*, May 1943, pp. 332-34).

American Developments in Air Conditioning and Refrigeration during War Period, by W. H. Carrier, *Engineers' Digest* (*Br. Ed.*). January 1946, pp. 2-5.

Progress in Air Conditioning in the Last Quarter Century, by W. H. Carrier (ASHVE TRANSACTIONS, Vol. 42, 1936, p. 321).

II—Dehumidification by Solid Adsorbents

By Walter L. Ross*, Johnstown, Pa.

Time will permit only a cursory treatment of the extensive topic of solid adsorbent dehumidification. Accordingly, I would like to devote a few minutes to each of the following sub-topics: *First*, adsorption and desorption definitions; *Second*, typical operating characteristics of solid adsorbent dehumidification machines; and *Third*, properties and characteristics of commercial solid adsorbents.

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Adsorption and Desorption

Adsorption may be thought of as an approach to an equilibrium condition which is reached when the vapor pressure above the water on the desiccant is equal to the vapor pressure of the water vapor in the gas being dried. Characteristically the adsorbent has a very low vapor pressure compared to that of the air and a tremendous surface-to-volume ratio, the former causing the flow of vapor from air to desiccant and the latter providing a large *storage space* for the entrained moisture. From its adsorption characteristics it has been estimated that the pores in 1 cu in. of silica gel have a surface area of approximately 90,000 sq ft. Or, stated in another way, a tablespoon of silica gel has a surface area greater than a football field. It is in this vast number of small diameter interstices that the gel, after attracting the vapors, condenses and holds them, illustrating the phenomenon of surface capillary adsorption. Upon reaching the equilibrium state after continued adsorption, there is no longer a flow of vapor in either direction. When this point is reached the adsorbent is said to be saturated, and before further dehumidification can be effected the substance must be reactivated. By heating the adsorbent the entrained condensed vapor is literally boiled off by raising its pressure to a point where it exceeds the counteracting forces holding it to the adsorbent, leaving the substance ready to resume its role as a dehydrator.

Dehumidification by solid desiccant may be performed either statically or dynamically. The former method entails no artificial means for circulating the air through the desiccant. This method of preservation is used extensively in packaging for overseas shipments and domestic storage.

On the other hand, dynamic dehumidification implies the forced passage through the desiccant bed of the air being treated. This method is used in installations such as dehumidified warehouses and ships in the so-called *Mothball Fleet* where large volumes of air must be dried.

As the air is forced through the activated desiccant, it surrenders a certain amount of its water vapor. The rate of moisture pickup is a function of many variables, some of which will be discussed later. The ratio of water adsorbed by the desiccant to the amount of water vapor entering the desiccant during that time is known as *adsorption efficiency*. A characteristic of adsorbents is that this efficiency remains constant and high from the beginning of an adsorption cycle until a later point in the cycle when the efficiency begins to drop. This point is known as the *breakpoint*, and the time from the beginning of adsorption to this point is known as the *breakpoint time*. Adsorption carried beyond the breakpoint continues at an increasingly slower rate until the adsorbent is completely saturated. This point is known as *completion*.

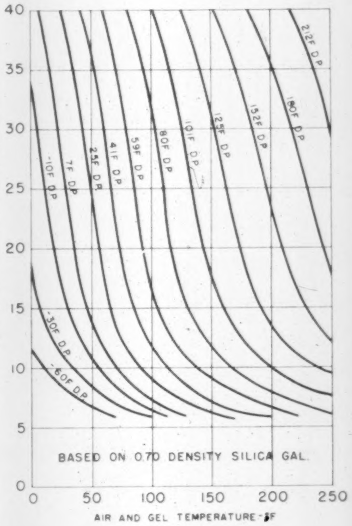

Fig. 1 — Silica gel — water vapor equilibrium isopiestics

Symposium Paper

At the Symposium on Dehumidification at the Chicago Meeting last month, a total of 5 papers were presented and discussed. This is Paper II in full. Paper V is also included in this issue of the JOURNAL SECTION, starting on p. 164. The remaining papers are expected to appear in early issues.

Adsorbents generally contain, even when reactivated, about 5 to 7 percent water (dry weight basis) which is known as *residual moisture*. The term *useful concentration* designates the percent moisture in the adsorbent over and above the residual quantity, based on the dry weight of the desiccant.

During reactivation when the latent heat requirements diminish

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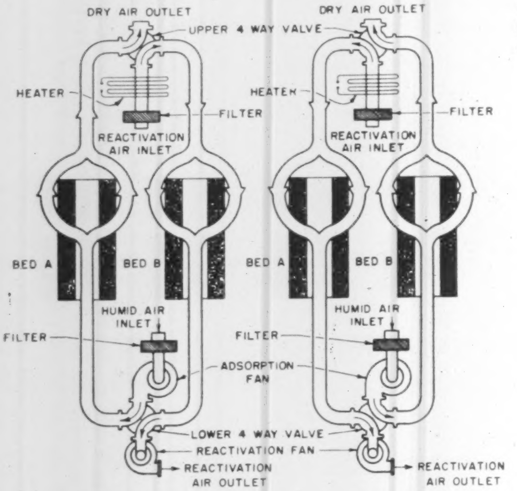
Presented at the Symposium on Dehumidification at the 63rd Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Chicago, February 1957.

(*i.e.*, after most of the water is desorbed), the heat input goes into sensible heat gain to the passing air stream. This is reflected in a sharp increase in the effluent dry-bulb temperature. This point, measured from the beginning of desorption, is designated *temperature-rise time*. Regeneration past this point, until the adsorbent is in moisture equilibrium with the air stream, is known as *complete desorption*. The energy expended in the heater per unit weight of water desorbed is called *economy of desorption* and usually has the dimensions of kilowatt hour per pound.



BED A DRYING
BED B REACTIVATING

BED A REACTIVATING
BED B DRYING

Fig. 2 — Typical dual-bed dehumidification machine schematic flow diagram

1. TYPE OF DESICCANT
2. GRAIN SIZE OF DESICCANT
3. AGE OF DESICCANT (NUMBER OF REGENERATIONS)
4. AREA OF BED NORMAL TO AIR FLOW
5. SHAPE OF BED
6. DEPTH OF BED
7. DRY WEIGHT OF DESICCANT
8. PACKING OF THE DESICCANT
9. AIR FLOW RATE
10. TEMPERATURE OF ENTERING AIR
11. MOISTURE CONTENT OF ENTERING AIR
12. CONTACT TIME (A FUNCTION OF INLET FACE VELOCITY AND BED DEPTH)
13. BAROMETRIC PRESSURE
14. PRESSURE DROP THROUGH THE BED
15. DURATION OF CYCLES
16. METHOD OF REACTIVATION
17. REACTIVATION TEMPERATURE
18. RATE AND MAGNITUDE OF HEAT SUPPLY DURING REACTIVATION
19. HEAT STORAGE CAPACITY OF THE BED
20. AFTER-COOLING VS. ADIABATIC OPERATION

Fig. 3 — Variables involved in dynamic dehumidification with solid adsorbents

During adsorption there is a liberation of heat which results in elevating the effluent temperature. This heat is the latent heat of vaporization of the adsorbed liquid plus an added quantity known as the *heat of wetting*. All of the released heat is known cumulatively as the *heat of adsorption*. In comfort air conditioning it is often necessary to cool this effluent air, but in most other dehumidification applications this heat is not objectionable, and no provisions are made for its removal. For this reason the process is known as *adiabatic adsorption*. Although such operation only approaches the adiabatic it is so designated to differentiate it from *isothermal adsorption* where the outlet gas is cooled down to inlet temperature.

The foremost factors in equilibrium adsorption capacity are the temperature of the adsorbent and the dry-bulb and dew-point temperatures of the air. The relationships existing between these variables is illustrated on Fig. 1. These isopiestics are plotted with gel and air temperature as the abscissa, percent water in the gel (dry weight basis) as the ordinate, and air dew-point temperatures (or vapor pressures) as the parameters. Several important characteristics of the adsorbent are brought out by these curves. Note that the curves become asymptotic to the X-axis somewhere between 5 and 6 percent moisture content, representing the residual moisture. Note that at constant air and gel temperatures the amount of moisture adsorption varies directly as air dew-point temperature, i.e., as the air approaches saturation condition the equilibrium moisture content of the gel increases. At saturation the percent water in the gel is about 40 percent of the dry weight of the gel for all temperatures. At fixed dew-point temperature, moisture concentration decreases as the temperature of the air and gel is increased.

Solid Sorbent Dehumidification Machines

Fig. 2 illustrates schematically a typical dual-bed dehumidification machine. The basic components in the adsorption circuit consist of a humid air inlet, a filter, an adsorption blower, a desiccant bed, and a dry air outlet. In the reactivation circuit there is an air inlet, a filter, a source of heat, a desiccant bed, a reactivation blower and the wet air outlet. The dual-bed unit is popular because, with a system of cross-over valves, it lends itself to continuous adsorption whenever necessary. Both the adsorption and the regeneration processes are normally controlled by timers, and since the regeneration cycle is shorter than the drying cycle, it is possible to always have 1 of the 2 beds adsorbing.

There are a great number of factors which effect the efficiency and rate of dehumidification as well as the general operating characteristics of a D/h machine. Some of these are cited in Fig. 3.

Next, let us examine a typical set of operation curves based on one adsorption cycle and one reactivation cycle on the same bed. The test conditions are tabulated on Fig. 4.

Looking at the adsorption cycle, notice that the entering air dry-bulb, dew-point and flow rate are essentially constant while the remaining 3 curves, outlet dry-bulb, outlet dew-point and weight of water picked up, vary from start to end of the cycle. At the outset the effluent dry-bulb is high owing to the elevated temperatures used in the preceding reactivation cycle. The relatively cool air rushing through the bed causes a rapid cooling of the bed as evidenced by the steep slope of the curve at the beginning of the cycle. The temperature drops at a rather constant rate, still at a level considerably higher than inlet temperature. This is because the air, in passing through the adsorbent, picks up the heat of adsorption. As complete adsorption is approached the outlet temperature levels off to about the temperature of the inlet air.

At the start of the run the inlet and outlet dew-points are the same because of the preceding complete reactivation. However, as soon as the relatively wet inlet air comes in contact with the freshly activated adsorbent, the moisture content of this air is greatly reduced. As the desiccant continues to adsorb moisture the dew-point of the leaving air begins to rise at an ever-diminishing rate until it too eventually flattens out, becoming horizontal at a temperature near that of the inlet dew-point, indicating *completion*.

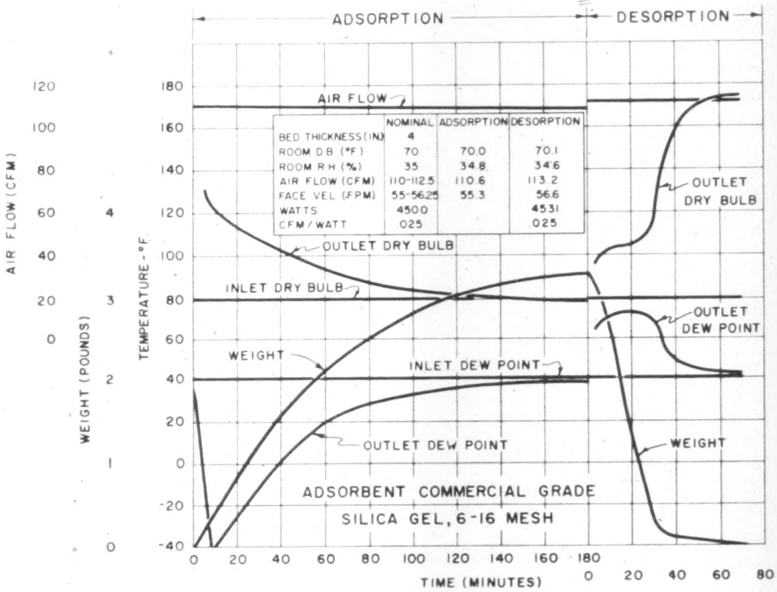


Fig. 4 — Characteristic operation curves for a solid adsorbent dehumidifier

The weight curve is self-explanatory.

The desorption or reactivation curves can be described in a like fashion. Once again the rate of reactivation air flow as well as the inlet air temperature and moisture content are constants. The outlet dry-bulb rises rapidly at the start of the cycle with the energizing of the heaters. During this first phase of reactivation the main portion of the heat goes to elevating the temperature of the air and the saturated desiccant. The temperature then begins to level off, rising slightly at a fairly constant rate. It is during this stage of the cycle that the adsorbed moisture is vaporized and carried out of the bed by the warm air stream. Since most of the supplied heat is used to boil off the entrained moisture during this period, the air temperature rises only slightly. When most of the water has been removed from the adsorbent the outlet dry-bulb begins to rise sharply. This point marks the end of efficient reactivation since the same amount of heat is expended to remove an ever-diminishing amount of moisture. Additional desorption occurs until the outlet dry-bulb levels off, indicating that the desiccant is in vapor pressure equilibrium with the heated inlet air and that the entire system is in thermal equilibrium.

The reactivation outlet dew-point temperature also rises rapidly at the beginning of the cycle. As the warm air purges the desiccant, the effluent moisture content rises considerably above that of the inlet air. The outlet dew-point remains fairly constant during the period of rapid and constant desorption after which it begins to drop and gradually approach inlet dew-point conditions as reactivation nears completion.

The reactivation weight curve illustrates the rapid and essentially constant rate of desorption shortly after the heaters are energized. This continues until most of the adsorbed water has been removed at which point the desorption rate sharply diminishes.

Note from Fig. 4 that under the conditions specified, complete adsorption took about 3 hr while the reactivation was completed in 70 min.

Different ambient conditions require different durations of both adsorption and reactivation, but in all cases it is economical to terminate adsorption at or around the *breakpoint* and to terminate reactivation at or around the *temperature-rise time*.

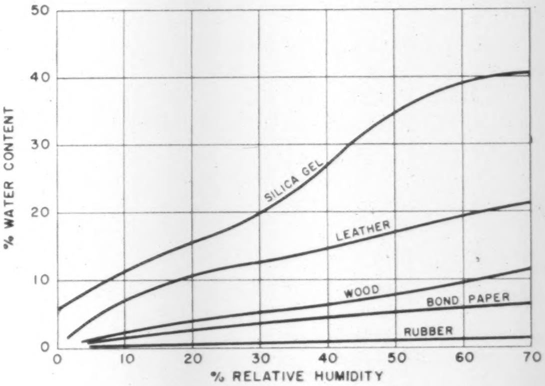


Fig. 5 — Relationship between ambient relative humidity and water content of materials at room temperatures

Some of the variations and innovations that have been employed on D/h units are: (*a*) the use of a cylindrical rotating bed, part of which is adsorbing while another part is being regenerated; (*b*) the use of gas or steam for reactivation; (*c*) unique valve designs to effect the switchover from one bed to another; (*d*) embedded heaters; and (*e*) the use of a cooling process after reactivation to take advantage of the inherently higher adsorption capacity at low temperatures.

Commercial Solid Adsorbents

It should be pointed out that commercial solid adsorbents are not unique in their affinity for water. In fact, all solids are capable of removing water vapor from gases. Fig. 5 shows this capacity for several common materials as compared to a desiccant. One of several reasons, however, can prevent a material from being adopted for dehumidification use. *First*, the relative cost may be high. *Second*, the equilibrium capacity may be low. *Third*, the material may not be capable of repetitive reactivation. Other factors to be considered are crushing strength, ability to stay in place, attrition characteristics, pressure drop and various others.

Time will not allow a description of the more common commercial solid adsorbents which are silica gel, activated alumina, activated bauxite, bead-type desiccants, and molecular sieves. There are a number of excellent technical bulletins dealing with these materials available from the desiccant manufacturers. Some of these publications are listed in the bibliography.

Conclusion

There are a number of different ways to dry air. Processes in use are: (*a*) cooling; (*b*) compression; (*c*) adsorption with both liquids and solids; (*d*) adsorption with solids; and (*e*) combinations of the foregoing. What then are the particular pros and cons of using solid adsorbents as compared to the other methods? On the advantage side one can list (1) high dew-point depression; (2) high drying efficiency; (3) not corrosive; (4) easily handled; and (5) easily reactivated. The disadvantages are: (1) the drying process of a given bed is generally cyclic rather than continuous; (2) rather high heat requirements for regeneration; and (3) the possibility of plugging, fouling or disintegrating the adsorbent by contaminants.

Bibliography

1. Activated Alumina, Its Properties and Uses (Aluminum Company of America, 1949).

2. Amero, R. C., J. W. Moore and R. G. Capell (*Chemical Engineering Progress*, 43, 349, 1947).

3. *The Adsorption of Gases and Vapors, Vol. I, Physical Adsorption*, by S. Brunauer (Princeton University Press).

4. Capell, R. G., R. C. Amero and J. W. Moore (*Chemical and Metallurgical Engineering*, 50, 7, 107, 1943).

5. Dehydration of Air and Gas with Davison Silica Gel. (Davison Chemical Corp., *Technical Bulletin No.* 201).

6. Silica Gel, Its Use as a Dehydrating Agent, by F. C. Dehler (Presented at George Washington University, June 23, 1941).

7. Hubard, S. S. (*Industrial and Engineering Chemicals*, 46, 356, 1954).

8. Vapor Adsorption, by E. Ledoux (Chemical Publishing Co., Inc., 1945).

9. Technical Information on Drying of Gases and Liquids (Linde Air Products Co., December, 1954).

10. Adsorption, by C. L. Mantell (McGraw-Hill Book Co., Inc., 1945).

11. The Performance of a Solid Adsorption Dehumidifier, by E. R. Queer and E. R. McLaughlin (Pittsburgh Lectrodryer Corp., *Bulletin No.* 214, 1948).

12. Dynamic Characteristics of a Solid Adsorbent, by W. L. Ross and E. R. McLaughlin (*Refrigerating Engineering*, 59, 21, 167, 1951).

13. ASHAE Research Report No. 1541 — An Analysis Method for Predicting Behavior of Solid Adsorbents in Solid Sorption Dehumidifiers, by W. L. Ross and E. R. McLaughlin (ASHAE Transactions, Vol. 61, 1955, p. 321).

14. Drying Gases with a Modern Drying Agent (Socony Mobil Oil Co., Inc., *Technical Bulletin*, 1950).

V—Typical Dehumidification Problems and Their Solution

By E. R. Queer*, University Park, Pa.

Dehumidification, or the reduction of moisture, in industrial processes is becoming more prevalent and the industry therefore is seeing a steady growth. The most extensive application is that used for the preservation of equipment and long-term storage of materials. In the processing of industrial gases it is necessary to remove virtually all the water so as to make them bone dry. The proper packaging of pharmaceutical products requires that they be dry; therefore, the atmosphere in much of the manufacturing process must be kept dry and clean, particularly in the packaging rooms. Many controls are actuated by a pneumatic system and the air therein is maintained clean and dry by the use of instrument air dryers. In addition to these and other applications most air-conditioning installations require dehumidification. Both the solid desiccant and liquid desiccant dehumidifiers are finding an increased application in these fields.

Symposium Paper

This is the full text of Paper V which was presented and discussed at the Symposium on Dehumidification held as one session at the 63rd Annual Meeting in Chicago on February 26, 1957. Paper II presented at that same Symposium starts on p. 161 of this issue of the Journal Section. The papers, I, III, and IV are expected to appear in early issues.

Low-humidity atmospheres as a means of providing long-term preservation of materials is not a new development. The Egyptians in antiquity at the burial of their rulers placed many articles in the tombs with the bodies. These burial places are located in arid lands where the natural humidities rarely rise above 15 percent relative humidity (RH).

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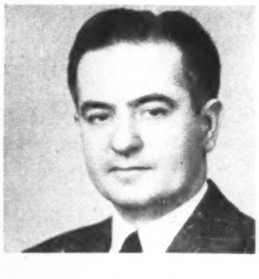
Presented at the Symposium on Dehumidification at the 63rd Annual Meeting of the American Society of Heating and Air-Conditioning Engineers, Chicago, February 1957.

Through the centuries embalmed bodies and articles have been maintained in an excellent state of preservation. However, it was soon discovered when these relics were brought into the temperate zone climates that they deteriorated rapidly when exposed to the normal atmospheres. This example from history effectively demonstrates the feasibility of using low humidities for inhibiting the deteriorating effect of humid atmospheres on materials.

Long-Term Preservation of Ships

Early in 1944 the U.S. Navy began an intensive examination of procedures to preserve the inactive fleets when hostilities of World War II would cease. From some prior experience it had been demonstrated that dehumidification through the use of solid chemical desiccants was feasible to apply to submarines. Packaging procedures used during the war also indicated that the application of these practices to ships would provide the desired long-term storage of the fleets. There were many technical problems that had to be resolved before the program could be launched. With the war being actively prosecuted, it was difficult to find a ship to carry on experimental work. A sea plane launching ship was made available at the Philadelphia Naval Shipyard for this purpose.

In this ship, both dynamic and static dehumidification were applied to the various compartments. Dynamic dehumidification is the use of an automatically operating machine that provides continuous desiccation as required to maintain a humidity condition that does not rise above a pre-set control value. There is an air distribution system to carry the dry air to the further extremities of the ship or space. Static dehumidification is for isolated compartments or containers where dynamic dehumidification cannot be used. The desiccant in containers is placed in the compartment and the compartment is sealed. In effect, this is an extention of Method II Packaging. Dynamic dehumidification is always used in preference to static dehumidification because, as can be seen, it provides mass or large scale dehumidification and is more economical.



E. R. QUEER — director and professor of engineering research, The Pennsylvania State University, University Park, Pa.; presently Society first vice president. Received B.S. in 1926 and M.S. in 1928, The Pennsylvania State College (now University). Associated with the College of Engineering and Architecture since graduation. Captain, USNR. Consultant numerous government agencies and architect-engineer firms.

Through research and experimental demonstration it was found that corrosion, mildew, rotting and general deterioration could be virtually stopped when a 45 percent RH or lower was maintained. Owing to the fact that a good portion of the ship is out of the water and exposed to the elements, the dry-bulb temperatures therein do vary over a wide range. Since it was not practical nor economical to install large enough capacity dehumidifiers to provide the desired minimum humidities at all times, it was decided to use 30 percent RH as the maximum allowable value for interior of the ship. This gave a certain margin of safety that was desired. The maintenance of this condition aboard ship did not add much to the cost since it was relatively easy to secure tight closure on the exposed top side. Furthermore, at such low humidities the ships were made free of all vermin because there was no water for them to subsist on.

The fire mains were drained as were all other piping, boilers and containers. Since the fire mains were relatively large pipes and extended the full length of the ships at all major deck levels, it was decided to use them as the air distribution system. The quantity of dry air required to maintain the conditions desired is relatively small. A high-pressure fan forces the dry air from the machine through the mains to the compartments. The air finds its way back to the machines through open compartment doors and passage ways. In some cases ventilation trunks are used for returns. The system is a recirculating one with no weather air provided except that entering the ship by breathing. This is sufficient to prevent oxygen depletion or the accumulation of noxious gases.

The dehumidification loads in a ship are made up of the surface adsorbed load, breathing load and that from personnel that may enter the ship for inspection. No part of an inactive ship is inhabited. A dual-bed solid desiccant machine having $7\frac{1}{2}$ lb per hr water removal rate at 70 F and 35 percent RH is sufficient to handle 300,000 cu ft of ship volume. For the first 10 to 12 weeks the machine will operate almost continuously to remove the residual water adsorbed in the painted surfaces' organic materials and such loose water as is not entirely drained or swabbed up. The residual load is much bigger than usually anticipated. For example, for a 10,000-ton cruiser it was estimated that 10,000 lb of water was removed during this period. After the initial drying the machine runs on the average of about 35 percent of the time and usually at night. During extended periods of cloudy rainy weather when the temperature is relatively constant, the machines will operate very little since the breathing load is very small. A control and recording system was developed for this application. Eight sensing stations having both a humidity and dry-bulb element at each station were distributed throughout the zone being dehumidified. Lines from these were led back to a central station where a continuous or intermittent record was maintained. When an area is too dry or not dry enough, all the attendants need to do is adjust a valve in the fire main in that area to secure the required drying. In this way, the care and maintenance of the system is kept relatively simple.

Dehumidification of Warehouses

The ship problem is relatively easy since the exterior envelope thereof can be made relatively tight. When the military services wanted to apply mass preservation for long-term storage to land buildings and warehouses, the problem became more complex owing to the difficulty of closure. Most of the applications were for existing buildings, therefore much time and effort had to go into the preparation of the building.

The humidity requirements for warehouse dehumidification for preservation are not as stringent as metal closures because the heat capacity of the warehouse structure is greater. With the windows blanked against solar loads, the diurnal temperature change is materially reduced. Therefore, it was found practical to maintain the desired degree of preservation with a 40 percent RH. There have been occasions where a 50 percent RH has been acceptable when an excellent job of protective coatings is used on machine tools. In the latter case heating was used to provide the dehumidification. Normally this procedure is not recommended because the relative humidity is above the safe limit for long-term storage.

The dehumidification loads in warehousing consist of the water absorbed in the dunnage, the water absorbed in the structural lumber and masonry, the transmitted loads through the walls and floors, and the infiltration load. The dunnage consists of forest products and the contained water is leveled off at some value in relation to the relative humidity to which the material has been exposed for some time. The Forest Products Laboratory data[1] on lumber are used to estimate the magnitude of this load. In order to limit the transmitted load it is necessary to treat the exterior walls of the buildings with a vapor barrier. The usual practice is to spray masonry walls on the weather side with an asphalt-mastic compound and then blow light colored granules into the asphalt-mastic while it is still in a plastic stage. The light colored granules help minimize the solar heat loads. Since the roofs are made of waterproof compounds that are good vapor barriers no other treatment for them is necessary. Concrete floors do not require any special treatment except to fill cracks that may have developed. The infiltration load which includes the breathing load is always the largest one with which to contend. A good coating job along with chinking of cracks and holes will provide adequate closure. The doors are the real problem. If they cannot be made sufficiently tight, then new doors are required or a second door in the form of an interior storm door should be provided.

The magnitude of the various water loads can vary over a wide range depending upon such factors as the weather conditions, rate of stock turnover and the degree of building closure. A typical load summary for a 100,000-sq ft building in which the initial drying has already been accomplished is as follows:

	Lb/Day
Dunnage	355
Transmission	
a. Walls	154
b. Floor	290
Infiltration	715

Obviously the infiltration load is of major magnitude and the controlling factor in the design of the dehumidification system. A load of this size suggests that air locks on the main loading doors might be in order. On new buildings designed for dehumidified storage and having tight doors, air locks may be justified on several main doors if the operational arrangements can be planned properly. In the majority of instances examined, air locks were not found economically practical. In practice it is difficult to get the operating personnel to use the air locks properly because they do hamper the flow of traffic into and out of the warehouse. On the other hand where the doors on existing warehouses are difficult to make tight and to replace, a tight internal storm door arrangement is justifiable.

Caves

The most recent application of dehumidified storage has been in abandoned limestone mines. After completing mining operations there are large volumes of space available for which limited use has been found until recently. In the mining operations large columns of limestone which occupy about 20 percent of the gross area are left standing to support the roof and overburden and in most cases the geological formation is quite stable so that these supports are adequate. This permits the development of the space for storage facilities which can be economically dehumidified when the mines are relatively free of liquid water. One of these so-called caves has been completely developed at Atchison, Kan., by Army Ordnance-Industrial Production Division for the storage of stand-by machine tool equipment. Several others are in various stages of design development for the storage of military materials and one is being developed for general industrial storage.

In order for it to be feasible for a mine to be developed there should be virtually no free water running into the mine. It should be so situated that it is not subject to flooding from high waters. It is desirable that the cave be located close to good rail and highway transportation and if air and water transportation are convenient they enhance the value of cave for storage purposes.

Owing to the fact that the temperature of the cave is extremely constant, usually not cycling more than 1 to 2 deg over the period of a year, it is safe to select a maximum of 42 percent RH for the storage humidity. The normal temperature of the cave will be very close to that of the ground water temperature. The water loads to be considered in a cave to be used for storage along with their magnitudes per gross acre from a recent design are as follows:

	Lb/Day
1. Entrained water in dunnage of stored materials	106
2. Transmitted load from rock	1740
3. Weather air ventilation	467
Total	2313

The entrained water load varies with the condition of exposure of the dunnage and the amount of material moved into storage. The transmitted load size is quite problematical but experience has shown that this is the most substantial of all the loads. To give some idea of the magnitude of the entrained water in a rock column with a normal 2 percent water content by weight consider a 10 ft diameter column 25 ft high. There are 100,000 lb of water entrained therein much of which will have to be removed eventually if the mine is dehumidified. Fortunately the rate of emission is slow — not exceeding

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[1] *Wood Handbook*, Agriculture Handbook No. 72, USDA.

5 to 7 grains per hour per square foot of rock surface at about 70 F and 40 percent RH in the cave. If the cave is heated to a higher temperature the rate of water emission from the rock is increased. It has not been found economically feasible nor practical to coat the rock surfaces to reduce the transmitted load. The weather air ventilation load is greatest in the summer months and is negative in much of the late fall, winter and spring months. As a result, with the proper arrangements, weather air can be used at these times for dehumidification.

Cave installations are large, sometimes involving several dehumidification machines having capacity for handling 50,000 cfm air each and removing 1000 lb of water per hour therefrom. The energy source for reactivation is usually best handled if natural gas is available. In the midwest, gas is available to most installations and the rates vary from $0.25 to $0.15 per 1000 cu ft at 960 to 1000 Btu per cu ft. The gas can be burned directly into the desiccant bed for reactivation of the solid desiccants. Fuel oil or gas can be used for indirect reactivation of both liquid and solid desiccant dehumidifiers. In the smaller machines used in warehouses and shops the usual practice is to employ electrical energy for reactivation.

Industrial Applications

As industrial processes become more complex the need for dryness, even extreme dryness, is expanding rapidly in an ever increasing number of applications. Industrial gas drying is spreading into numerous fields. For example, fuels, such as natural gas, are cleaned and dried before storage underground to assure that valves and the transmission lines will not freeze from condensed moisture during extremely cold weather when the gas is needed most. Propane likewise must be clean and dry to prevent ice accumulations. Other gases such as bottled oxygen, nitrogen, hydrogen and acetylene must have a high degree of dryness. In the manufacture of liquid oxygen and ozone, the weather air supplied in the particular process must be clean and dry.

Many industrial processes including refineries are operated on pneumatic controls. The air lines for the controls are often exposed to weather air which can fall to −20 F. Obviously, this air must have a dew-point temperature below this value if the equipment is to function properly. Instrument air dryers and cleaning equipment are doing an excellent job in specially conditioning the air for this purpose.

The pharmaceutical industry has need for dry air in the tank storage of raw materials and chemicals to prevent contamination, in the processing and packaging of the finished products. Dryness is a particularly important requirement in packaging to permit a free flow of the gelatinous coated capsules and coated pills.

Large dryers are required for the manufacturing and processing of special alloys. At high temperatures the moisture breaks down and oxidation occurs which impairs the quality of the alloy. Many special requirements arise from time to time in manufacturing procedures. For example, in the assembly of safety glass it is absolutely essential that the glass be completely dry during fabrication. Where high dielectrics are involved, such as electronic components and electric power transformers, the materials used in the assemblies must be dry. In the assembly of electronic parts they often must be extremely dry.

The large bulk of the dehumidification machine manufacturing business is concentrated in handling these problems. Other special applications are for wind tunnels and altitude chambers where fogging occurs and interferes with observations and photography. Dehumidifiers for supersonic and sonic wind tunnels are some of the largest in existence. Breathing of moisture into tanks is inhibited by the use of containers of desiccants through which the weather air flows before entering the tanks. These are known as breathers.

General Problems

All materials will come into vapor pressure equilibrium with the atmosphere to which they are exposed. Organic compounds usually absorb water until an equilibrium condition is reached. Inorganic, hard-surfaced materials will absorb water on the surface. The thickness of the film is determined by the vapor pressure of the atmosphere and the dry-bulb temperature of the object. It is this adsorbed film that is the cause of corrosion on metals and the difficulties encountered in the manufacture of safety glass. By reducing the relative humidity of the atmosphere in which the object is exposed the thickness and continuity of the molecular water film can be reduced, thus making it possible to inhibit corrosion and practical to carry out manufacturing processes.

When exceedingly low dew-points are required, in the range of −80 to −100 F, the problem becomes quite complex to maintain these low values after producing them. Solid desiccants such as activated aluminia, micro sieves, and certain special compounds are capable of producing the low dew-points when properly handled. However, the containers and ducts must be of materials that will not transmit moisture, otherwise the desired conditions cannot be maintained. Rubber, rubber compounds and virtually all plastics transmit more moisture than can be tolerated when low dew-point conditions are involved. Metals, metal foils coated with plastics and glass are the principal items used for ducts and containers.

For dew-point temperatures of −50 F and upward silica gel is useful. The liquid desiccants when properly handled are effective at higher temperature dew-points wherein large quantities of air and moisture are to be handled.

Summary

The chemical desiccants serve a very useful purpose in the field wherein low dew-points are desired. When low energy cost fuel is available they begin to become competitive with other means of latent heat removal in air conditioning systems. This is particularly true with natural gas which can be fumed directly into the desiccant for reactivation. Chemical desiccant dehumidifiers have served well in the field of long-term storage and preservation and are finding a rapidly expanding industrial market.

Odors and Surfaces

By A. B. Hubbard*, Bloomfield, N. J.

Your Technical Advisory Committee on Odors has outlined and set up a research project on surface characteristics. The surfaces are those used in building interiors; *e.g.*, metals, fabrics, plastics and paints. The study is not concerned with control of the primary odors of such materials because this is a well recognized problem; the producer knows it must be solved and his customer sees that he does. Instead, the present project is to determine quantitatively what surfaces, blameless in themselves, will do with ambient odors.

Everyone knows of certain rooms that are persistently odorous. Usually the original source is obvious, in other cases it is hard to describe the odor or to imagine its source. The basic mechanism, however, is an example of adsorption and desorption. A complex blend of aromas such as tobacco smoke in room air is taken up by surfaces in that room. Each of the many different odorous vapors has a different characteristic with respect to each of the many kinds of surfaces. Therefore, the odor components picked up are in different proportions than in the fresh tobacco smoke. After smoking ceases, the original smoke soon disappears, but now the *play back* starts. The new blend, as it is delivered back to the room air, has an unfamiliar smell; perhaps called *stale* or *musty* in mild cases and ranging up to *nauseating* or *nasty* in worse situations.

At first glance this would seem to be no concern of the air-conditioning engineer; but rather the responsibility of those who develop, manufacture and apply materials for building interiors. However, the air-conditioning user is unlikely to make fine distinctions in placing blame for poor results. The air-conditioning contractor promises a comfortable ambient and high quality air and it is up to him to make good in one way or another. We therefore can collectively meet this obligation by taking the lead in developing methods of measuring the odor performance of materials commonly used in air-conditioned spaces.

Rating materials and making engineering predictions would not seem difficult if water vapor, instead of odorous vapors, was the problem. Investigation of moisture transfer and storage is relatively easy because measurement techniques and instruments are available.

Direct measurement of odorous vapors is hopeless because the quantities and concentrations are fantastically small in physical terms. Moreover, the relation between partial pressure of the vapor and olfactory sensation varies with the kind of odor, and over an enormous range. One compound may produce an overpowering stench at one part per billion in air while another is barely detectable at 100,000 times that concentration. ASHAE Research Laboratory engineers are making measurements in terms of olfactory sensation by an ingenious variation of dilution techniques developed in other laboratories for other uses.

The established unit of measurement is called *odor thresholds* or *number of thresholds*. To evaluate an odor, the observer dilutes it until it is barely detectable but still recognizable. The ratio of diluted mixture at recognition threshold and odorous sample volume describes the odor level in terms of thresholds.

The Research Laboratory staff and a sub-committee of the TAC on Odors adapted the dilution scheme to surfaces in the following way. A known area of fabric, say, is allowed to come to equilibrium in a space kept at a constant level of a given odorant. The loaded sample is placed in a clean sealed container of such size that, when a new equilibrium is reached, the air in the container will be at threshold. The volume of threshold air per unit area of sample is a useful measure of amount of odor picked up by the material. It is analogous to specific heat. Another loaded sample may be *aired* in clean test room air for a measured time before being evaluated. The change with respect to time in *threshold cubic feet per square foot* is a measure of desorption rate analogous to heat transfer coefficient. Space does not permit detailing the effective, but basically simple, methods being pioneered in the Laboratory.

The TAC on Odors earnestly solicits financial support from the suppliers of materials and others who will benefit. Also important is reduction to practice by others.

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*Chairman, ASHAE Technical Advisory Committee on Odors.

Manoir Richelieu at Murray Bay, Quebec, Canada

Murray Bay Attracts Members for ASHAE Semi-Annual Meeting

The Semi-Annual Meeting of the Society will be held June 24, 25 and 26, 1957 in the Manoir Richelieu, Murray Bay, Quebec, Canada, with interesting papers and two symposiums planned for the 3-day meeting.

One of the symposiums is on Air Conditioning Instrumentation, and it will be moderated by Prof. C. H. Pesterfield, East Lansing, Mich. The other, a Symposium on Sound and Vibration, is to be moderated by J. B. Graham, Buffalo, N.Y.

It is the intention of the Program and Papers Committee, Walter A. Grant, Syracuse, N.Y., chairman, that approximately 14 papers will be included in the program. According to present plans one set of papers, covering the subject of Sound, may be scheduled for a session prior to the Symposium on Sound and Vibration.

The Montreal Chapter Committee on Arrangements, under the general chairmanship of D. Lorne Lindsay, is already making headway with a number of special events for the lighter side of the Semi-Annual Meeting. There will be, of course, the annual ASHAE Golf Tournament, the Semi-Annual Banquet and other entertaining events.

Working with Mr. Lindsay are assistant chairmen W. G. Hole, H. G. S. Murray, B. J. Horsburgh and R. J. Ker. The honorary chairmen are F. A. Hamlet and G. Lorne Wiggs. Montreal Chapter members in charge of particular phases of the arrangements are W. W. Timmins, Reception and Registration; A. E. Horsburgh, Ladies; Leo Garneau, Transportation and Hotel Reservations; Ralph Grossman, Finance; G. N. Martin, Entertainment; and A. Williams, Sessions.

Considered one of the most entrancing sites in all French Canada, the Manoir Richelieu is located some 90 miles east of historic Quebec City, on the north shore of the St. Lawrence River.

Members wishing to bring their families to the Semi-Annual Meeting will find that Canada offers many splendid opportunities for sightseeing and vacationing. It is possible to travel to Murray Bay by car, train or steamer. However, the most scenic route is by steamer, leaving from Montreal in the evening and arriving about noon the following day. Members who drive as far as Montreal and then wish to make the boat trip will find suitable garage facilities for leaving the car in Montreal until their return. Arrangements have been made for overnight accommodation at the Sheraton Mount Royal for members desiring to stop over in Montreal. It is also possible to arrive in Montreal by air or train and then continue on to Murray Bay by boat. Similar arrangements can be made from Quebec City.

In planning arrival at Murray Bay, it will be well to keep in mind that for arrival before Monday, June 24, it is necessary to depart on the steamer leaving Montreal on Friday evening, June 21. The next departure from Montreal is on Sunday, arriving at Murray Bay about noon on Monday, June 24th.

For those who wish to enjoy a longer cruise on the St. Lawrence and the Saguenay it is suggested that plans be made to either depart from Montreal and allow an extra day for further travel beyond Murray Bay and return, or make the trip up the Saguenay after the Semi-Annual Meeting upon departure from Murray Bay.

Those who prefer driving directly to Murray Bay should follow the following route from Montreal: Route 2, Montreal to Quebec; Route 15, Quebec to Baie St. Paul; Route 15-A, Baie St. Paul to Murray Bay.

There is daily train service, except Sunday, leaving Montreal in the morning and arriving in Pointe-au-Pic (Murray Bay) in early evening.

Upon arrival at the Manoir Richelieu it will be discovered that there are many outdoor activities including a salt-water pool, horseback riding, tennis and championship golf course.

Remember the date, June 24-26, 1957, and plan to make reservations as soon as the special form is received in the mail.

ROUND-TRIP STEAMER SCHEDULE

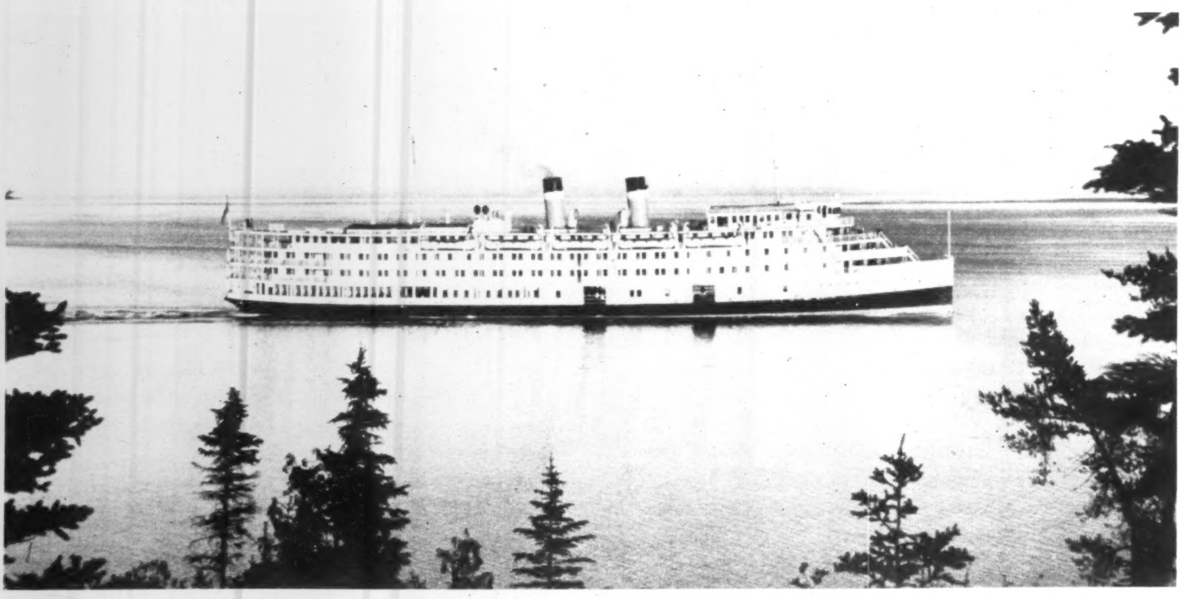
Leave Montreal	Arrive Murray Bay
Friday, June 21, 6:45 p.m.	Saturday, June 22, 11:30 a.m.
Sunday, June 23, 6:45 p.m.	Monday, June 24, 11:30 a.m.

(For Saguenay River Trip en route take June 21 Steamer, disembarking at Murray Bay, Sunday, June 23, 1:10 p.m. EST)

Leave Murray Bay	Arrive Montreal
Thursday, June 27, 1:00 p.m.	Saturday, June 29, 7:00 a.m.
(includes Saguenay River Trip)	
Friday, June 28, 1:25 p.m.	Saturday, June 29, 7:00 a.m.
(direct to Montreal)	

STEAMER RATES PER PERSON

	Stateroom 2 Berths, Hot & Cold Water	Stateroom 2 Berths, Lav., Hot & Cold Water	Stateroom Twin Beds & Bath
Round Trip Montreal to Murray Bay, including meals, transportation	$44.70	$47.70	$56.70
Round Trip Montreal to Saguenay River with stopover at Murray Bay, including meals, transportation	68.50	74.50	86.00



Steamer Traveling the St. Lawrence River Between Montreal and Murray Bay

GOLDEN JUBILEE FOR AIR POLLUTION CONTROL GROUP

June 2-6, 1957 is the time announced for the Golden Jubilee Meeting of the *Air Pollution Control Association.* Activities are to be at the Sheraton-Jefferson Hotel in St. Louis. Cosponsors of this meeting are the Air Pollution Abatement Committee of the *American Meteorological Society*, the Committee on Air Pollution Controls of *ASME*, the *American Institute of Chemical Engineers* and ASHAE.

Arrangements are in process for papers on the subject to be prepared by members of the Society. It is expected that the papers submitted by ASHAE will stress those aspects of air pollution which have to do with removing air pollution from the air inside building structures. This will include such factors as odors and dust. Papers presented by the other sponsoring organizations are planned to cover such matters as prevention of pollution of air by stack and chimney gases, and by gases released by chemical processes.

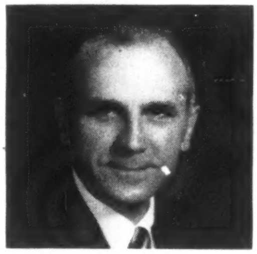
C. H. Pesterfield, professor of mechanical engineering, Michigan State University, and member of Council, has been designated representative of the Society in connection with the planning of this program. Arrangements are substantially complete, and it is expected that this Jubilee Meeting of *APCA* will prove to be one long remembered for the quality of its program. All members of the Society are invited.

ACTIVITIES OF SOCIETY CHAPTERS

Sketched here are the features of recent meetings of Society Chapters. A few chapters were honored by visits from Society officers and Council members. Programs were generally technical in nature, but several nontechnical programs are also described. Included, too, are some personal items about members who received special mention at Chapter meetings.

Visits by Officers and Council Members

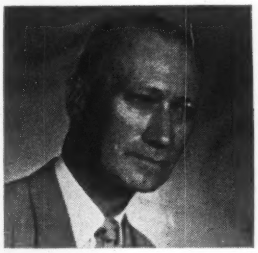
John W. James, Society president, was the guest speaker at a NEW YORK Chapter meeting. Mr. James, who is vice president, research, McDonnell & Miller, Inc., Chicago, Ill., replied to the question *Does Air Conditioning Provide a Healthful Indoor Environment?* He cited research conducted by the Society and cooperating institutions on the physiological reactions of people entering and leaving air-conditioned spaces from either hot or comfortable environments and returning to the original environment. The research indicated no harmful effects. On the contrary, President James cited many beneficial effects of air conditioning, such as increased production, accelerated recovery for convalescents, and relief afforded hay fever sufferers. At the end of his talk, President James answered a number of questions from the audience. • • •



John W. James
Chicago, Ill.

PHILADELPHIA Chapter members and their guests heard P. B. Gordon, first vice president of the Society, as their guest speaker. Vice Pres. Gordon, who is vice president, Wolff & Munier, Inc., New York, N.Y., spoke on the subject of *A Contractor's Look at the Air Conditioning of Existing Office Buildings.* • • • John Everetts, Jr., member of Council and regional director, Regional Area 1, visited the PITTSBURGH Chapter, and extended greetings from the Council and President James. Mr. Everetts asked that all members file with the Chapter's board of governors any suggestions for items to be placed on the agenda for the regional meeting, Albany, N.Y., March 29.

P. B. Gordon
New York, N.Y.



John Everetts, Jr.
Philadelphia, Pa.

Technical Programs

At an ARIZONA Chapter meeting A. R. True, Westinghouse Engineering & Manufacturing Co., Venice, Calif., covered the subject of motor controls. He touched on the basic principles of some recent developments in electronic controls that have found wide acceptance in manufacturing plants. • • • ARKANSAS Chapter members heard O. J. Ress, chief engineer, Mueller Climatrol Division, Worthington Corp., Milwaukee, Wis. Mr. Ress presented an interesting discussion on the background of rating codes, testing methods and application to heating equipment for domestic and commercial installations, covering *A.G.A.*, Underwriters' Laboratory, Inc., *NWAH&ACA* and commercial codes or requirements. • • • Preselected questions relating to the position of manufacturers' agents were handled by a panel representing this field at an ATLANTA Chapter meeting. The panel members were J. A. Dodd, owner, John A. Dodd Co.; W. J. McKinney, district manager, American Blower Corp.; J. W. Miller, heating and cooling representative, American Radiator & Standard Sanitary Corp.; J. L. Underwood, owner, John L. Underwood Co., Inc.; and George Holden, Jr., owner, George Holden & Assoc., all of Atlanta, Ga. • • • William Nash, Armstrong Cork Co., Lancaster, Pa., told the AUSTIN Chapter *What's New in Thermal Insulation.* Demonstrating with slides and a film, Mr. Nash brought out the many demands now being placed on insulation because of lower temperatures of fluids and higher outside temperatures. • • • A comprehensive talk on the performance and operational costs of waterless air conditioners was well received by a BALTIMORE Chapter audience. The speaker was W. J. Radle, Sales Division, Chrysler Airtemp Corp., Dayton, Ohio. • • • BATON ROUGE Chapter scheduled a program with James Kidd, chief, Inspection Division, Department of Public Works, Baton Rouge, La., as guest speaker. Mr. Kidd explained how the Inspection Division operates for the 3-fold purpose of zoning, fire protection and building regulation. • • •

L. G. Miller
East Lansing, Mich.

Humidity, Friend or Foe was the provocative title selected by L. G. Miller, consultant, Furnace Division, Jackson & Church, Saginaw, Mich., for his presentation to the BLUEGRASS Chapter. His informative talk received a standing ovation. • • • Following a business meeting, CINCINNATI Chapter members adjourned to the main auditorium to hear H. H. Korff, engineer, Johnson Service Co., whose talk was entitled *High Velocity Double-Duct Air Distribution.* Mr. Korff discussed the operation of this type of system in relation to temperature and pressure control. • • • J. B. C. Thomas, Hartford Electric Light Co., informed his CONNECTICUT Chapter audience on the use and application of heat pumps and electric heating for residences in the Hartford area. • • • The *Space Satellite,* a talk by J. C. Morris, Tulane University, was programmed by DELTA Chapter for a meeting to which the wives of the members were invited. Vice Pres. L. R. Maxwell welcomed the guests. • • • EMPIRE STATE CAPITAL members enjoyed a presentation on the *Problems of Industrial Air Cleaning.* J. M. Kane, chief engineer, Dust Control Division, American Air Filter Co., Louisville, Ky., was the speaker of the evening. • • • On another occation, the Empire State Capital Chapter featured a talk on the uses of natural gas for both domestic and industrial heating. The speaker, P. C. Wiesner, Niagara-Mohawk Power Corp., Troy, N.Y., also showed a movie concerning the production and storage of natural gas. • • • Various aspects of high-velocity air distribution systems were covered by 4 speakers at an ILLINOIS Chapter meeting. Sam Sachs, chief of heating, ventilating and air conditioning, Skidmore, Owings & Merrill, Chicago, explained why high-velocity systems should be used. W. L. Batchelor, assistant chief engineer, Tuttle & Bailey, Inc., New Britain, Conn., presented illustrated slides on high-velocity plenum units, their development, application and installation. The fan industry's contribution to high-velocity systems was noted by William Tracy, manager, sales development department, Sturtevant Division, Westinghouse Electric Corp., Boston, Mass. The discussion on controls for high-velocity systems was by Norman Janisse, assistant chief engineer, Johnson Service Co., Milwaukee, Wis. • • • Well-chosen slides accompanied a talk by Art Staat, regional manager, Natural Gas Equipment Co., before the INLAND EMPIRE Chapter. The topic was the application of gas unit heaters for space heating. Both commercial and industrial applications were treated by the speaker. • • • Two speakers graced the IOWA Chapter platform — N. L. Rutgers, manager, commercial sales, and H. C. Bierwirth, Jr., chief engineer, Commercial Division, Lennox Industries, Des Moines, Ia. Mr. Rutgers discussed developments in forced air heating installations, and classroom heating. Plans for a newly-constructed auditorium and office building were shown by Mr. Bierwirth. • • • R. A. Gonzalez, director of application engineering, Airtemp Division, Chrysler Corp., Dayton, Ohio, told his KANSAS CITY audience that it probably would be hazardous to make concrete statements about the cost of residential air conditioning, since individual family usage varies considerably. Mr. Gonzalez and his associates ran tests in 3 different locations on 12 identical houses with the same equipment. They found that the habits of the people varied greatly, with proportionate variation in the cost of operation. • • • MASSACHUSETTS Chapter featured a program with 2 speakers and a tour. R. D. Williams, plant engineer, and L. R. Grant, chief engineer, Carling Brewing Co., Natick, Mass., spoke on *Mechanical Equipment of a Modern Brewery.* The talks followed a guided tour of the brewery plant. • • • A MONTREAL Chapter member, R. E. J. Layton, chief mechanical engineer, T. Pringle & Son, Ltd., Westmount, Quebec, Canada, told his fellow members about the design features of mechanical services in a modern brewery. The talk was illustrated with colored slides. The meeting was adjourned and then reconvened at the Labatts Brewery, Ville LaSalle, for a conducted tour of the plant's mechanical services. • • • A lively question and answer session followed a talk on *The Treatment of Circulating Water,* given by Fred Humphrey, Zia Co., Los Alamos, N. Mex., at a NEW MEXICO Chapter meeting. • • • Two visitors from the Pentagon discussed problems in their respective fields at a NORTH JERSEY Chapter meeting. W. T. Smith, chief, refrigeration and air-conditioning section, Headquarters United States Air Force, and C. J. Cooper, chief, heating section, The Department of the Air Force, Washington, D.C., spoke on the funds spent and to be spent on improving heating, ventilation and air conditioning at U. S. Air Force bases. • • • J. T. Avery acted as moderator for a panel discussion given at a NORTHERN OHIO Chapter meeting. The panel members were D. A. Rupert, sales engineer; S. R. Guilbert, air-conditioning engineer; and George Evans, consulting engineer. Each member explained his position and function in the heating, ventilating and air-conditioning field. • • • OKLAHOMA Chapter presented a discussion by R. L. Bernhard, manager, centrifugal compressor department, American Blower Corp., Detroit, Mich., on the history of the centrifugal compressor up to present design. • • • Two speakers took opposite sides of a presentation on the *Relationship of Heating Surface to Boiler Output.* Debating the issue were R. A. Ward, vice president, Carmichael Heat & Power Ltd., and W. J. Wilkinson, president, Power Plant Contractors Ltd., Toronto, Ont., before an ONTARIO Chapter audience of 100 persons. Considerable discussion from the floor touched on various aspects of the subject. • • • *Legal Relations between Engineer, Contractor and Material Supplier* was the topic of an enlightening talk by George McBroom, attorney-at-law, Harroun and Shidler, at a PACIFIC NORTHWEST Chapter meeting. Three aspects of the problem were covered: the legal implications when specifications permit an *or equal,* the rights of a sub-contractor when he makes a firm offer to the general con-

Society Laboratory Receives Valuable Radiometer

A two-sphere radiometer developed by the Minneapolis-Honeywell Regulator Company Research Center has been given to the Society Laboratory. Above (center) Warren H. Scott, of Minneapolis-Honeywell, is thanked by Director E. R. Kaiser (right) while R. G. Huebscher of the Laboratory staff (left) looks on. The instrument is expected to be a valuable tool for studying and measuring mean radiant temperatures at the Laboratory where a major program has been launched to re-evaluate the Society comfort charts.

C. M. Ashley
Syracuse, N.Y.

tractor who later is awarded the contract, and the supplier or manufacturer's liability in case of defective materials. ● ● ● At a joint meeting held by Pacific Northwest Chapter and the Pacific Northwest Section of *ASRE*, C. M. Ashley, president of *ASRE*, spoke briefly on the *Engineering Manpower Crisis* preliminary to his main address. In his second talk, *Sound—a Design Factor in Air Conditioning*, Mr. Ashley defined fundamental technical terms and then explained the measurement of sound, relating sound levels to noise levels of current air-conditioning equipment. A demonstration of sound effects and the principles involved was presented by tape recording. The subject was well handled, and the talk, thoroughly enjoyed by the membership. ● ● ● A coverage on *Future Sources of Power* was given to the PITTSBURGH Chapter by E. F. Kratz, Westinghouse Electric Corp. Mr. Kratz gave an informative talk, taking into consideration population growth, trends and efficiency, and demand for energy. After the presentation, Mr. Kratz replied with authority to the numerous questions from the floor. ● ● ● The science editor of the *Toledo Blade*, R. A. Bruner, speaking to the TOLEDO Chapter members, proposed that engineers should act as liaison between scientists and the public. He felt that engineers had not performed their function of explaining scientific advances to the public in ways that could be readily understood. ● ● ● D. H. Northrup, president, Cambridge Filter Corp., Syracuse, N.Y., informed a gathering of VIRGINIA Chapter members and guests on the subject of *High Efficiency Filters as Used in Industry and Comfort Applications*. ● ● ● A discussion of the various air-cleaning methods used in the air-conditioning industry was presented at a WEST TEXAS Chapter meeting by C. D. Wright, district manager, air filter department, American Air Filter Co., Louisville, Ky. ● ● ● The program for a WESTERN MICHIGAN Chapter meeting consisted of an afternoon tour of the Upjohn Company plant, Kalamazoo, Mich. The tour covered the production area of the plant and the catwalk area overhead, with inspection of the heating, ventilating, cooling, and sterilizing equipment, and ductwork. The trip was of great interest to the entire group, since the plant features complete air conditioning throughout, and many areas are isolated and maintained under sterile conditions. Pres. F. L. Murray extended thanks to George Jepson of the Upjohn Co. for his efforts in arranging the tour. ● ● ● A rapid-fire question and answer period followed a talk by C. M. Wilson, general sales manager, Anemostat Corporation of America, New York, N.Y., at a WESTERN NEW YORK Chapter meeting. Mr. Wilson's subject was *High Velocity Air Distribution*.

Non-technical Programs

Two hundred fourteen people attended a dinner dance given during the holiday season by the BLUEGRASS Chapter in cooperation with *ASRE* and *KSPE*. O. J. Hill was chairman for this annual affair. ● ● ● *What Is Next in the American Foreign Policy* was treated by Graham Hovey, of the editorial staff of the Minneapolis *Star Tribune* in a stimulating talk before a joint meeting of the MINNESOTA Chapter and the Twin City Section of *ASRE*. ● ● ● Spontaneous laughter from his MONTREAL Chapter audience greeted Gordon Sinclair's recounting of humorous experiences in radio broadcasting. The appreciation of the chapter was expressed by J. B. Flanagan. ● ● ● NEBRASKA Chapter held its annual smoker night together with a business meeting. Pres. L. J. Paulsen received a unanimous vote in favor of continuing the custom. ● ● ● Members of the NEW MEXICO Chapter were joined by their wives for the Christmas party held at the La Posada in Santa Fe. The evening proved to be thoroughly enjoyable. ● ● ● Three guests from Oklahoma City, F. R. Denham, Paul Keefe and Paul Spray, presented the NORTHEASTERN OKLAHOMA Chapter members with an entertaining motion picture. The production and acting were by Oklahoma Chapter members. ● ● ● Members and guests of the OREGON Chapter enjoyed their ladies' night, held in the Florentine Room of the Columbia Athletic Club, Portland. ● ● ● A dissertation on the art of distilling peppermint, zestfully entitled *Why Pour It Down the Drain?*, was presented by A. D. Hughes, professor of mechanical engineering, Oregon State College, at another Oregon Chapter meeting. Professor Hughes supplemented his talk with slides and movies, which depicted research and engineering accomplishments in this field by the speaker and his students.

Personal Items

An announcement was made by Pres. J. B. Hoaglund, ARIZONA Chapter, that he had appointed W. A. Biddle and E. P. Maxwell as chapter representatives to the *Arizona Council of Engineering and Scientific Associations*. Mr. Biddle was elected vice president by the Council. ● ● ● Pres. B. E. Segall, Jr., AUSTIN Chapter, appointed A. C. Lagow as member and B. J. Barnhart as alternate of the Chapters Regional Committee. ● ● ● R. E. Dressell was commended at a BALTIMORE Chapter meeting for the preparation of the chapter roster. ● ● ● E. L. Crosby presented a Life Membership certificate to R. L. Leilich, Baltimore Chapter. ● ● ● NEBRASKA Chapter selected Pres. L. J. Paulsen as a delegate to the 63rd Annual Meeting of the Society. ● ● ● A donation to the Nephrosis Fund in memory of L. H. Jackett was announced by Secy. R. D. Wilson, NORTHERN OHIO Chapter. ● ● ● Elected as a nominating committee for the OREGON Chapter were K. R. Murhard, W. B. Morrison, T. E. Taylor, E. A. Ponder and E. R. Lokey. J. D. Kroeker was named chairman and B. W. Farnes, alternate. ● ● ● Vice Pres. E. H. Riesmeyer, Jr., thanked B. E. Schmitz and R. M. Guthrie for volunteering to become co-editors of their PITTSBURGH Chapter publication, *Pitt Clippings*. Compliments were extended to all concerned with the new publication by John Everetts, Jr., regional director, Regional Area 1. ● ● ● Mr. Everetts presented a Life Membership certificate to R. B. Stanger, who served as president of the Pittsburgh Chapter in 1932. ● ● ● PURDUE UNIVERSITY Student Branch held an election of officers for the spring semester. G. T. Dollas will be the new president, with G. T. Vail, Jr., as secretary and J. D. Faris as co-ordinator.

CANDIDATES FOR MEMBERSHIP

Listed here are the names of 125 men who are candidates for membership or advancement in membership grade.

Members are requested to assume their full share of responsibility of receiving these candidates into membership by advising the Executive Secretary before March 31, 1957, of any whose eligibility for membership is questioned. Unless such objection is made these candidates will be voted upon by the Council.

Note: **Advancement* †*Reinstatement*

Arizona *(Region 4)*

Fredrickson, S. A., Br. Sales Mgr., Carrier Corp., Phoenix.

California *(Region 4)*

Baxter, C. D., Sales Engr., Lemon Grove Sheet Metal Works, Lemon Grove.

Buckley, K. E., Sales Engr., The Powers Regulator Co., San Francisco.

Dyson, O. A., Supvsr. of Indus. Service, Southern California Gas Co., Los Angeles.

Howe, W. W.†, Designer, Bechtel Co., San Francisco.

Ivanick, F. M., Mech. Engr. Assoc., Dept. of Water & Power of Los Angeles, Los Angeles.

Meier, Robert, Mech. Engr., Rule, Dietze & Conkle, Los Angeles.

Paxson, H. G., Jr., Sales Engr., Air Conditioning Supply Co., Los Angeles.

Ross, F. D., Regl. A-C. Engr., Rheem Manufacturing Co., South Gate.

Stecher, L. S.*, Cons. Mech. Engr., Sacramento.

Colorado *(Region 3)*

Higgins, W. J., Design Engr., Paul H. Koch, Cons. Engr., Denver.

Journal Section

Kueck, E. F., Owner, Maxwell Heating, Denver.

Oliver, A. J., Asst. Bldg. Engr., The Dow Chemical Co., Denver.

Walker, R. J.†, Engrg. Group Leader, The Dow Chemical Co., Denver.

Connecticut *(Region 1)*

Allen, D. C., Chief Engr., The Horton Co., Hartford.

Shadford, R. J., Jr., Partner, Henri van Zelm and Assocs., West Hartford.

Illinois *(Region 2)*

Horner, J. S., Cons. Engr., Libertyville.

Hymen, H. M.*, Chief Engr., H. G. Prizant & Co., Chicago.

Schaefer, F. J., Chief Engr., R. B. Hayward Co., Chicago.

Iowa *(Region 3)*

Clark, H. W., Vice Pres. & Sales Mgr., Plumb Supply Co., Des Moines.

Stodola, R. D., Engr., Chandler Co., Cedar Rapids.

Kansas *(Region 2)*

Clevenger, L. K., Partner, White Air Conditioning & Heating Co., Wichita.

Evans, H. S., Jr., Engr., Pray Bros., Wichita.

Louisiana *(Region 5)*

Hutchinson, P. H., Jr., Sales & Appl. Engr. Westinghouse Electric Corp., Sturtevant Div., New Orleans.

Maryland *(Region 5)*

Harman, R. E., Sales Engr., Taze & Hewitt, Baltimore.

Romine, C. L., A-C. Engr., Henry Adams, Inc., Baltimore.

Siegel, R. H.*, Mech. Engr., Green Associates, Inc., Baltimore.

Massachusetts *(Region 1)*

Fowlie, A. H., Vice Pres., Fred Williams Inc., South Boston.

Kimball, J. B., Mech. Engr., Richard D. Kimball Co., Boston.

Michigan *(Region 2)*

Crothers, G. T., Vice Pres., Stapert-Pratt-Bulthuis-Sprau & Crothers, Kalamazoo.

Minnesota *(Region 3)*

Anderson, C. S., Estimator, Morgan-Gerrish Co., Minneapolis.

Carlson, R. E., Sales Engr., Morgan-Gerrish Co., Minneapolis.

Mississippi *(Region 5)*

Miller, E. C., Jr.†, Chief Engr., Bldg. Operations, United Gas Pipe Line Co., Jackson.

Missouri *(Region 3)*

Etling, Oliver, Design Engr., Ferris & Hamig, St. Louis.

Wolfs, K. E., Sr. Engr., Burns & McDonnell Engineering Co., Kansas City.

New Jersey *(Region 1)*

Andrews, W. C., Br. Mgr., Sarco Co., Inc., Newark.

Freeman, W. I., Jr., Pres., Tri State Equipment Co., Preakness.

Hull, H. D., Partner, Parmelee & Hull, East Orange.

MacLean, R. M.*, Sr. Technologist, Socony Mobil Oil Co., Inc., Paulsboro.

Wirth, T. J., Dvlpt. Engr., Edwards Engineering Corp., Pompton Plains.

New York *(Region 1)*

Altieri, J. L.*, Sr. Mech. Engr., Voorhees, Walker, Smith & Smith, New York.

Calvacca, P. J., Designer, Voorhees, Walker, Smith & Smith, New York.

Hutten, J. P., Supvsr. Mech. Engrg. Dept., Duchscherer & Oberst, Kenmore.

Judd, F. V., Chief Tech. Engr., Industrial Acoustics Co., Inc., New York.

Lisowski, Henry, Sales Engr., Taco Heaters, Inc., New York.

Maher, R. D., Sales Engr., The Nash Engineering Co., New York.

Mann, J. J. Assoc., Jaros, Baum & Bolles, New York.

McGuire, T. W., Sales Engr., Acme Industries Inc., New York.

Murray, R. J., Jr., Secy. & Gen. Sales Mgr., R. J. Murray Co., Inc., Schenectady.

Stronach, R. K., Dist. Repr., Warren Webster & Co., Syracuse.

Vanasse, R. J., Sr. Sales Engr., American Radiator & Standard Sanitary Corp., New York.

North Carolina *(Region 5)*

Montague, E. B., Jr., Sales Engr., Westinghouse Electric Corp., Charlotte.

Ohio *(Region 2)*

Campbell, W. F., A-C. Engr., The Hausman Steel Co., Toledo.

Jacobson, David, Estimator, B. & J. Jacobs Co., Inc., Cincinnati.

Koenig, W. C., Owner, W. C. Koenig & Assocs., Springfield.

Kramig, R. E., III, Pres., R. E. Kramig & Co., Inc., Cincinnati.

Pleimann, N. J., Proj. Engr. in charge of A-C. & Refrig., Hughes-Simonson, Inc., Dayton.

Oklahoma *(Region 6)*

Chase, J. C.†, Mfrs. Repr., Process Equipment Co., Tulsa.

Smith, C. C., Jr., Engr., Kay Engineering Co., Oklahoma City.

Oregon *(Region 4)*

Benz, D. L.*, Owner, Benz Co., Portland.

DeLica, D. R., Owner, Portland Metal Specialties Co., Portland.

Gornick, S. D., Sales, Armstrong Cork Co., Insulation Div., Portland.

Pennsylvania *(Region 1)*

Bartelme, F. G., Sales Engr., American Blower Corp., Pittsburgh.

Biro, J. E.*, Owner, Joseph E. Biro and Assocs., Easton.

Davidson, L. A.*, Sales Engr., Johnson Service Co., Philadelphia.

Dizenfeld, M. W., A-C. Engr., National-U.S. Radiator Corp., Johnstown.

Martin, T. P., Research Engr., Pittsburgh Plate Glass Co., Creighton.

McNatt, R. D., Ind. Appl. Engr., York Corp., York.

Texas *(Region 6)*

Anderson, R. G., Gen. Mgr., Bryant-Anderson Co., Houston.

Brown, A. E., Dist. Repr., American Furnace Co., Ft. Worth.

Broyles, J. E., Pres., Broyles & Broyles Inc., Ft. Worth.

Byars, W. A., Jr., Chief Engr., Brown & Olds Plbg. & Htg. Corp., El Paso.

Dunegan, Lee, Archt. Supvsr., Southwestern Bell Telephone Co., Mineral Wells.

English, J. H., Mgr. & Partner, Everett Engineering Co., Abilene.

Hiller, A. W., II, Chief Mech. Engr., Wyatt C. Hedrick, Archt. & Engr., Ft. Worth.

Honea, R. G., Vice Pres., Ace Furnace & Metal Works, Dallas.

Johnson, G. H., Jr., Mgr., Webb Air Conditioning Co., Ft. Worth.

Kastrin, W. J., Vice Pres., Southwestern Sheet Metal Works, El Paso.

McMurray, T. R., Sales Engr., General Engineering Corp., Ft. Worth.

Olson, B. R., Mech. Engr., Wyatt C. Hedrick, Archt. & Engr., Ft. Worth.

Price, P. M.*, Owner, Phil Price, Corpus Christi.

Reid, D. N., Jr., Mech. Engr., Yandell, Cowan & Love Engineering Co., Ft. Worth.

Romine, T. B., Jr.*, Cons. Engr., Ft. Worth.

Rovinsky, Erven, Engr.-Owner, Air Engineering, Ft. Worth.

Smith, D. S.*, Head, A-C. & Plbg. Design, Brown & Root, Inc., Houston.

Spangenberger, R. C., Repr., Johnson Service Co., Ft. Worth.

Tippett, G. R.*, Tippett and Gee, Abilene.

Walker, M. T., Sales Engr., J. P. Ashcraft Co., Inc., Ft. Worth.

Weeden, W. C., Pres., General Engineering Corp., Ft. Worth.

Yeary, W. R., Supvsr. Appl. Engrg., General Electric Co., Tyler.

Washington *(Region 4)*

Boyd, C. L., Repr., R. E. Chase Co., Seattle.

Dryer, R. L., Partner, Pacific Engineers, Seattle.

Wells, R. D.†, Mech. Engr., Young, Richardson & Carleton, Seattle.

Wisconsin *(Region 2)*

Cook, B. A., Sales Engr., The Trane Co., Milwaukee.

Coss, E. J., Engr., E. F. Klinger Assoc., Inc., Eau Claire.

Smith, R. B., A-C. Technician, R. D. Rodwell Cons. Engr., Milwaukee.

Canada *(Region 7)*

Baum, H. K., Pres., Armstrong, Baum Co., Ltd., Toronto, Ont.

Beaudouin, Jean, Dist. Mgr., Volcano Ltd., Quebec, Que.

Bouthillette, Roland, Assoc. Prof., Ecole Polytechnique, Montreal.

Christie, G. T.*, Sales Mgr., Alpha Manufacturing Co., Ltd., Winnipeg, Man.

Clarabut, W. E., Mgr., Equipment Division Farquhar Robertson Ltd., Montreal.

Dorval, Oscar†, Cons. Engr., Quebec, Que.

Grevemeyer, E. M., Htg. & Vtg. Engr., Falconbridge Nickel Mines, Ltd., Falconbridge, Ont.

Hagen, F. D., Mgr., Bartle & Gibson Co., Ltd., Edmonton, Alta.

Jones, C. M., Repr., Elias Rogers Co., Toronto, Ont.

Kallman, H. J., Owner, Hamilton Piping Co., South Hamilton, Ont.

Kane, F. B., Repr., Powers Regulator Company of Canada, Montreal.

Laing, W. R., Mgr., Industrial Sheet Metal Contractors (Alberta) Ltd., Calgary, Alta.

Lindenschmidt, F. J., Appl. Engr., Alpha Manufacturing Co., Ltd., Winnipeg, Man.

Mackay, W. J., Cons. Engr., Arvida, Que.

McGee, D. H., Repr., Amalgamated Electric Corp., Ltd., Montreal, Que.

McLachlan, M. K., Asst. Sales Mgr., Dunham-Bush (Canada) Ltd., Toronto.

Meir, J. C., Mech. Engr., Alberta Public Works, Edmonton, Alta.

Orr, J. D., Repr., Honeywell Controls Ltd., Calgary, Alta.

Picard, Robert, Design Engr., Tasse, Sarault & Assoc., Quebec, Que.

Roe, W. G., Repr., Trane Co. of Canada, Calgary, Alta.

Smith, G. G., Sales Engr., Honeywell Controls Ltd., Calgary, Alta.

Smolensky, Benjamin, Mgr., Riverside Plumbing Co., Calgary, Alta.

Tinkess, W. R., Mgr., Service Installation Dept., Honeywell Controls Ltd., Calgary, Alta.

Belgium

Leveque, P., Managing Dir., Chauffage & Ventilation Industriels, Brussels.

England

Galt, G. A., Sr. Htg. & Vtg. Design Engr., Co-operative Wholesale Society Ltd., Manchester.

Ireland

Lyons, S. S., Htg. & Vtg. Engr., Delap & Waller, Cons. Engrs., Dublin.

Lebanon

Nabhani, Khayreddin, Engr., United Technical Co., Trablus.

Venezuela

Bassotti, Armando, Tech. Dir., Emca Tecnica C. A., Maracaibo.

Pollak, Roberto, Asst. Dir., Emca Tecnica C.A., Caracas.

OBITUARIES

R. S. DILL, COUNCIL NOMINEE, DEAD AT 55

Richard S. Dill, chief of the Heating and Air-Conditioning Section, National Bureau of Standards, Washington, D.C., died of a cerebral hemorrhage on January 17. His untimely death, at the age of 55, came after he had been selected as a nominee for membership on the Society's Council for a three-year term. Mr. Dill's record of distinctive service to the Society included chairmanship of the Committee on Research and presidency of the Washington, D.C., Chapter.

Mr. Dill, who was born at New Bern, N.C., received a B.S. in mechanical engineering from North Carolina State College of Agriculture and Engineering in 1923. After graduation, he worked in the engine estimating department of the Newport News Shipbuilding & Drydock Co.

He began his lengthy association with the National Bureau of Standards in 1928. In the early years, he worked in the Automotive Section, testing automobile engines, accessories, fuels and lubricants. He became a member of the Heat Transfer Section in 1933. He then conducted and supervised research and testing on heating, air-conditioning and refrigerating equipment, insulating materials, air cleaning devices, water heaters and other equipment. He assumed his position as chief of the Heating and Air Conditioning Section in 1941.

A member of the Society since 1939, Mr. Dill served as a member of the Committee on Research for several years, and as its chairman, 1953-54. He also served on numerous technical advisory committees, and was the author or co-author of technical papers on a variety of subjects, published in the TRANSACTIONS of the Society.

R. S. Dill

He held membership in *ASME, ASRE, ASTM,* the Washington Academy of Sciences, and the Free and Accepted Order of Masons. He was a registered engineer in the District of Columbia.

DR. ROBERT W. KEETON, AIR ENVIRONMENT AUTHORITY, DIES AT 73

Robert Wood Keeton, distinguished physician who engaged in extensive air environment research, died of a heart ailment in St. Luke's Hospital, Chicago, on January 22 at the age of 73. Dr. Keeton, recipient of the Society's F. Paul Anderson Medal last year, retired as head of the department of internal medicine, University of Illinois, in 1951.

R. W. Keeton, M.D.

Associated continuously with the College of Medicine of the University of Illinois from his appointment as associate professor in 1925 until his retirement, Dr. Keeton provided much of the leadership which brought into fruition a long series of studies at the University, many in cooperation with the Society, on the subject of man's reactions to the effects of his air environment. The published results of this research provided outstanding contributions to the available information on this subject of practical use to engineers.

Dr. Keeton, one of the few members of the medical profession in this country to be continuously active in the air-conditioning field, joined the Society in 1943. He was a member of the Committee on Research from 1952-54, and served on the Technical Advisory Committee on Physiological Research and the Joint Committee on Standards for Comfort Air Conditioning. He is the author or co-author of numerous papers on physiological research that were presented at Society meetings and published in the TRANSACTIONS. Awarded the F. Paul Anderson Medal for 1956, Dr. Keeton was the first member of his profession to receive this distinction.

Dr. Keeton was born in West Point, Miss. He received bachelor degrees from Cumberland University, 1903; Millikin University, 1905; and the University of Chicago, 1907. The University of Chicago also awarded him an M.S., 1914; and he gained his M.D. from Northwestern University, 1916.

First associated with the University of Illinois in 1910 as an assistant in physiology, Dr. Keeton at different intervening periods served the Albany Medical College, Northwestern University, University of Chicago and Otto S. A. Sprague Memorial Institute, before returning to the University of Illinois in 1925. He was named a full professor in 1928, and head of the department of internal medicine in 1934. In 1939 he became a member of the National Board of Medical Examiners.

At the time of his death, Dr. Keeton was consulting physician at St. Luke's and Henrotin Hospitals, Chicago, and St. Francis Hospital, Evanston, Ill. In addition, he was consulting internist, Illinois Central Hospital. He was a practicing physician in Chicago since 1918, and was nationally recognized for his work in nutrition and diabetes.

In addition to the Society, Dr. Keeton was a member of the American College of Physicians, *American Medical Association, American Physiological Society, American Society of Pharmacology, Society of Experimental Biology and Medicine, Association of American Physicians,* The Central Interurban Club, *Chicago Society of Internal Medicine* and *The Institute of Medicine of Chicago, Chicago Heart Association* and many fraternal societies.

Surviving is his widow, Emily.

ROBERT E. DAUME
Pittsburgh, Pa.

Robert E. Daume, 64, Pittsburgh, Pa., died recently in Methodist Hospital, Houston, Tex., following an operation. Mr. Daume was the owner of a heating, piping and contracting business in his home town, Pittsburgh, for twenty-five years.

Previous to opening his own company in 1931, Mr. Daume had been connected with Joseph A. Langdon & Sons and The McVey Co.

Mr. Daume was a member of the Ben Avon Presbyterian Church, Pittsburgh Builders Exchange, and the Veterans of Foreign Wars.

His survivors include his wife, Katherine; two sons, Robert E., Jr., and Richard A.; and his sister, Harriet A. Daume.

LEE B. MANN
New York, N.Y.

Lee B. Mann, who was associated with The Trane Co. in New York, died in Boston, Mass., on January 7, several days after his 48th birthday.

He was born in Charlotte, N.C., and received a B.S. in electrical engineering from Georgia Institute of Technology in 1930. Directly after college graduation, he trained at a Carrier Corporation school, remaining in Carrier's employ for several years thereafter. From 1939 to 1952 he was connected with Boston Filter Co., Inc., advancing to vice president in charge of air conditioning, heating and ventilating. Previous to his recent move to New York, Mr. Mann served H. E. Whitten Co., Inc., Boston, as treasurer and member of the board of directors.

Mr. Mann, who was a member of *ASRE*, is survived by his wife and four sons. His home was in West Redding, Conn.

(For most recent listing of Society committee personnel see Frontispiece, JOURNAL SECTION*)*

Regional Organization of Society Chapters

The 67 Chapters and 6 Student Branches in North America are divided into 7 geographical groups, and each group is designated as a Regional Area. A Regional Director (names listed below) is elected by the Society membership for each Regional Area. These 7 Regional Directors and the 2nd Vice President of the Society, acting as chairman, constitute the Regions Central Committee.

There is also a Chapters Regional Committee for each Regional Area, and the members and alternate members of each of these committees are listed below, with the Regional Director as chairman.

Regions Central Com. A. J. Hess, Chairman	Regional Areas	Chapters Regional Committees		
		Chapter	Member	Alternate
No. 1 **John Everetts, Jr.** **Chairman**	Conn.	Connecticut (New Haven)	Walter Heywood, Jr.	Fritz Honerkamp
	Del., Maine			
	Mass.	Massachusetts (Boston)	W. G. Martin, Jr.	E. L. Blair
	Mass.	Western Massachusetts (Springfield)	A. M. Lovenberg	F. A. Ferraro
	N. H.			
	N. J.	North Jersey (Newark)	Martin Christesen	S. H. Nitzberg
	N. Y.	Central New York (Syracuse)	L. A. Childs	H. J. Morton
	N. Y.	Empire State Capital (Albany)	G. G. Davis	R. B. Taylor
	N. Y.	New York	Albert Giannini	J. B. Hewett
	N. Y.	Western New York (Buffalo)	C. W. Stone	G. E. Kuhn
	Pa.	Philadelphia	E. K. Wagner	P. H. Yeomans
	Pa.	Pittsburgh	R. M. Toucey	E. H. Riesmeyer, Jr.
	R. I., Vt.			
No. 2 **P. J. Marschall** **Chairman**	Ill.	Illinois (Chicago)	H. G. Gragg	
	Ind.	Indiana (Indianapolis)	James Jackson	H. E. Anderson
	Mich.	Michigan (Detroit)	E. F. Glanz	
	Mich.	Western Michigan (Grand Rapids)	F. L. Murray	B. J. Walter
	Ohio	Central Ohio (Columbus)	R. A. Wilson	W. A. Schoonover
	Ohio	Cincinnati	R. G. Anderson	T. D. Reiley
	Ohio	Miami Valley (Dayton)	J. B. Rishel	R. B. Walcott
	Ohio	Northern Ohio (Cleveland)	H. R. Canoyer	J. A. White
	Ohio	Toledo	J. F. Guest	J. M. Groskopf
	Wis.	Wisconsin (Milwaukee)	H. W. Alyea	R. D. Rodwell
No. 3 **A. B. Algren** **Chairman**	Colo.	Rocky Mountain (Denver)	A. S. Widdowfield	L. L. DeLong
	Iowa	Iowa (Des Moines)	R. S. Stover	W. A. Schworm
	Iowa	Illinois - Iowa (Moline, Ill.)	R. L. Graham	W. W. Dodge
	Kan.	Kansas (Wichita)	T. L. Roberts	J. C. Mikesell
	Minn.	Minnesota (Minneapolis)	E. T. Erickson	Fred Vogt
	Mo.	Kansas City	S. C. McCann	J. E. Miller
	Mo.	St. Louis	N. J. Hubbuch	W. P. Norris
	Mont.			
	Neb.	Nebraska (Omaha)	M. F. Stober	F. P. Manchester, Jr.
	N. D., S. D., Wyo.			
No. 4 **W. O. Stewart** **Chairman**	Ariz.	Arizona (Phoenix)	J. B. Hoaglund	E. P. Maxwell
	Calif.	Golden Gate (San Francisco)	J. E. Murray	K. F. Baldwin, Jr.
	Calif.	Sacramento Valley (Sacramento)	V. W. Thornburg	M. J. Delavan
	Calif.	Southern California (Los Angeles)	H. F. Ulovec	W. J. Biggar
	Idaho, Nevada			
	Ore.	Oregon (Portland)	W. B. Hayes	W. R. Nort
	Utah	Utah (Salt Lake City)	R. V. Oliver	D. B. Holford
	Wash.	Pacific Northwest (Seattle)	E. W. Triol	M. W. McKinstry
	Wash.	Inland Empire (Spokane)	J. A. Doyle	Max Tonn
No. 5 **C. B. Gamble** **Chairman**	Ala., Fla.			
	Ga.	Atlanta	J. A. Marshall	J. S. Edgar
	Ky.	Bluegrass (Louisville)	W. J. Killian	O. J. Hill
	La.	Delta (New Orleans)	J. H. Maloney	I. M. Richardson
	La.	Baton Rouge	J. F. Naylor, Jr.	A. W. Holland
	Md.	Baltimore	W. G. Robertson, Jr.	R. E. Dressell
	Miss.	Mississippi (Jackson)	D. F. Ingram	F. H. North
	N. C.	Northern Piedmont (Greensboro)	C. A. Cofer	C. E. Amick
	N. C.	Southern Piedmont (Charlotte)	G. C. Garrett	W. P. Wells
	S. C.	South Carolina (Columbia)	J. E. McMurray	B. A. Leppard
	Tenn.	Memphis	G. B. Ramsey	H. H. Wilson
	Va.	Virginia (Norfolk)	D. C. Delinger	D. L. Gusler
	D. C.	Washington, D. C.	P. R. Achenbach	J. H. Broome
	W. Va.			
No. 6 **D. M. Mills** **Chairman**	Ark.	Arkansas (Little Rock)	J. W. Thompson	K. A. Pettit
	La.	Shreveport	J. S. Malahy, Jr.	
	N. Mex.	New Mexico (Albuquerque)	R. G. Merryman	J. K. James
	Okla.	Northeastern Oklahoma (Tulsa)	C. H. Dollmeyer	J. D. Ryan
	Okla.	Oklahoma (Oklahoma City)	F. R. Denham	W. R. Johnson
	Texas	Austin	A. C. Lagow	B. J. Barnhart
	Texas	El Paso	J. O. LeBeau, Jr.	M. D. Goodwin
	Texas	North Texas (Dallas)	G. H. Meffert	O. H. Mehl
	Texas	South Texas (Houston)	E. B. Appling	A. B. Ullrich, Jr.
	Texas	Southwest Texas (San Antonio)	D. T. Kern	O. A. Brynie
	Texas	West Texas (Lubbock)		
	Texas	Fort Worth	C. R. Gardner	T. B. Romine, Jr.
No. 7 **W. G. Hole** **Chairman**	B. C.	British Columbia (Vancouver)	A. C. Martin	W. F. Keenan
	Man.	Manitoba (Winnipeg)	R. M. Fraser	A. H. Millar
	Que.	Montreal	D. L. Lindsay	H. G. S. Murray
	Que.	Châpitre de la Ville de Québec	P. J. Lamarche	Jean Veilleux
	Ont.	Ontario (Toronto)	C. L. Torry	Jack Thompson
	Ont.	Ottawa (Ottawa)	D. W. Banton	C. W. Watson
	Alta.	Northern Alberta (Edmonton)	W. C. Woods	P. M. Butler

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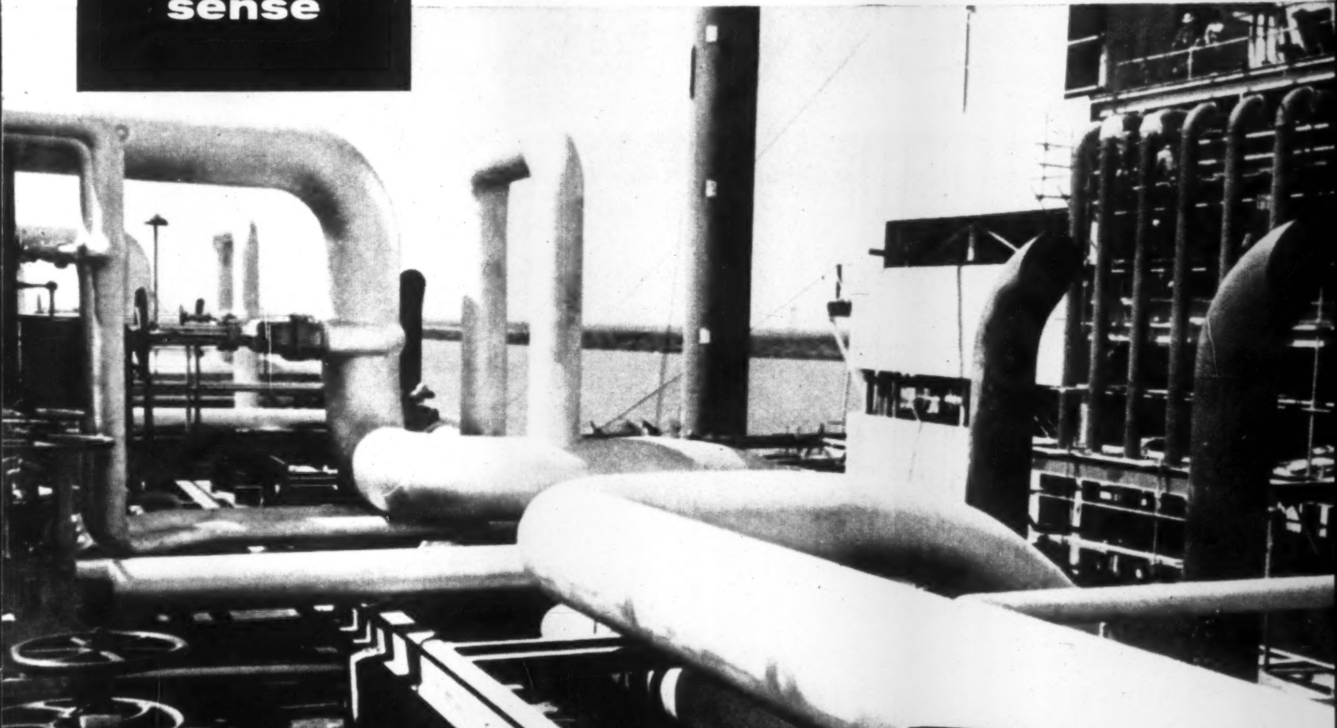

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Meet the new U. L. requirements with the most complete *line of flame safeguards in the industry—*

Honeywell Electronic Flame Safeguards

*—with exclusive Safety Start**

***SAFETY START provides an *automatic* self-check after any power interruption—before burner is restarted. Only Honeywell offers this safety feature.**

New U. L. requirements mean you can no longer use stack relays on commercial burners over seven-gallon size. And to meet new U. L. requirements, Honeywell now offers you the most complete line of Electronic Combustion Controls—with exclusive Safety Start.

When you choose from the Honeywell line, you have a complete choice—for the Honeywell line contains all types of controls for every possible combination.

- *You have a choice of flame detection.*
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- *Manual or automatic starting.*
- *Wide range of voltages.*
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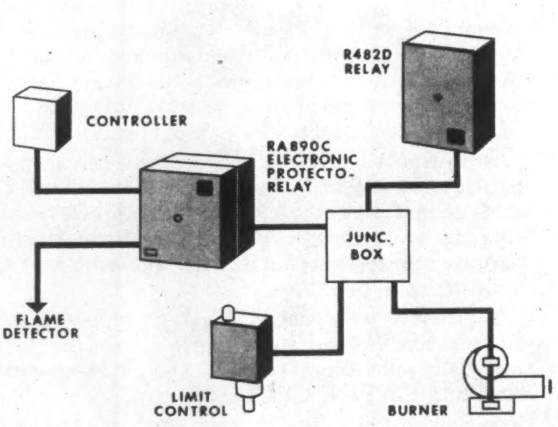
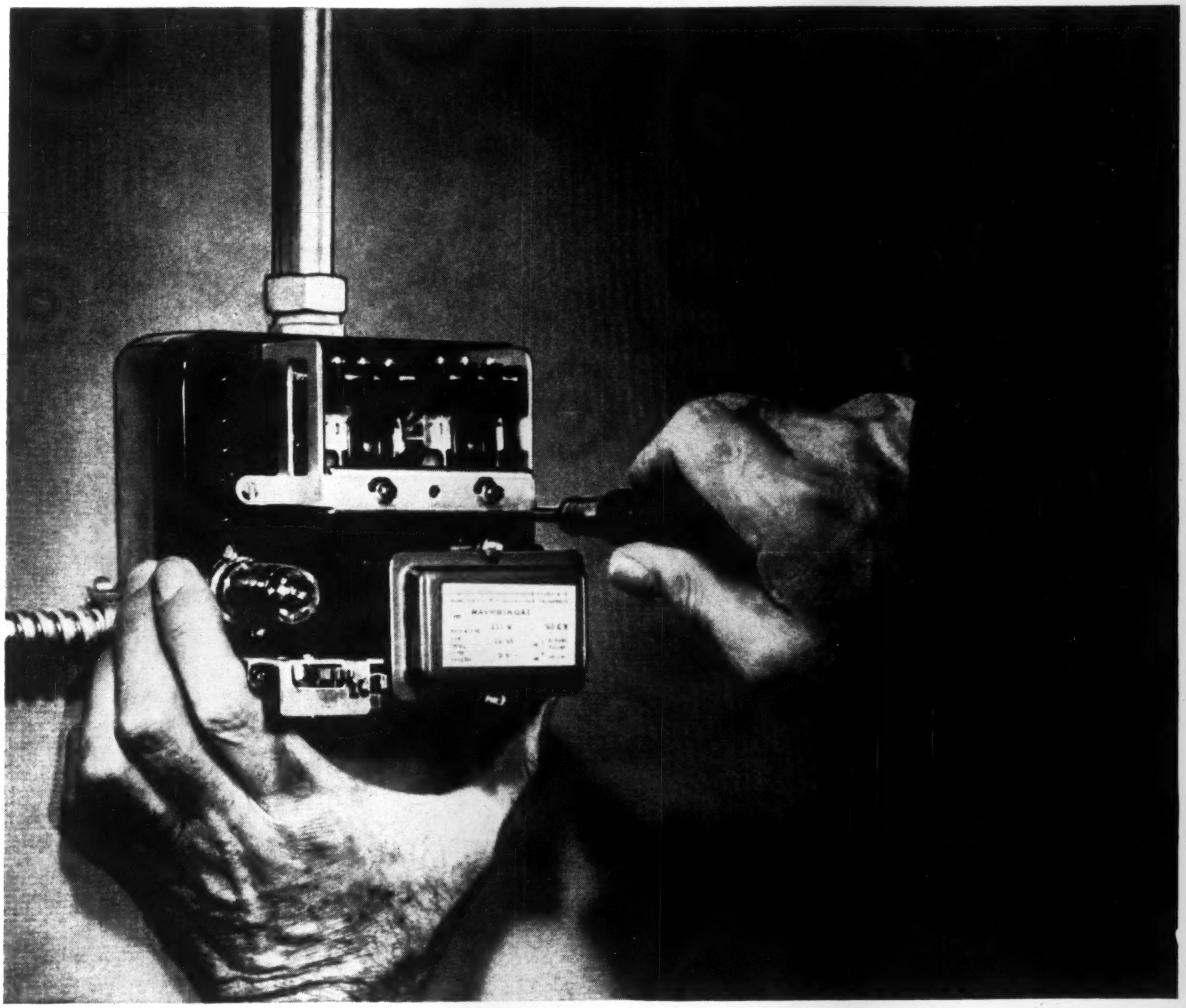
Only Honeywell makes control systems for every type of heating plant and fuel. With Honeywell you're able to rely on one supplier for all your controls.



This system provides fuel cutoff on flame failure plus post purge on safety lockout.



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"We effected a direct unit saving of 13% by switching to Pittsburgh Glasfloss Air Filters"

—says Howard F. Burrell, Chief Engineer
JOSEPH HORNE CO., Pittsburgh, Pa.

Howard F. Burrell, Chief Engineer, reports that Pittsburgh Glasfloss Filters are easy to handle, soft and light weight; and that this Fiber Glass filter does not splinter or shred.

"The filters we previously used in our storewide air conditioning system would shred and stick to fingers and clothing when handled," reports Mr. Burrell. "They were not uniform in quality and their performance was erratic.

"We switched to Pittsburgh Glasfloss Filters in February, 1956. We found Glasfloss Filters much easier to handle. They are lighter in weight and safer, too; this Fiber Glass does not splinter or shred. What's more, Glasfloss lasts longer, making it possible for us to effect a 13% saving over filters previously used.

"From an engineering point of view, we consider Glasfloss the most practical, economical and dependable filter possible to obtain for our system!"

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Pittsburgh Glasfloss Filters are made of fine, soft Fiber Glass, which provides greater dust-collecting areas without interfering with the air flow. They are moisture proof and fire resistant. Glasfloss Filters will give you top service from your air conditioning system, help you cut costs.

Contact your nearest Glasfloss Distributor or Pittsburgh Plate Glass Warehouse. *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.*

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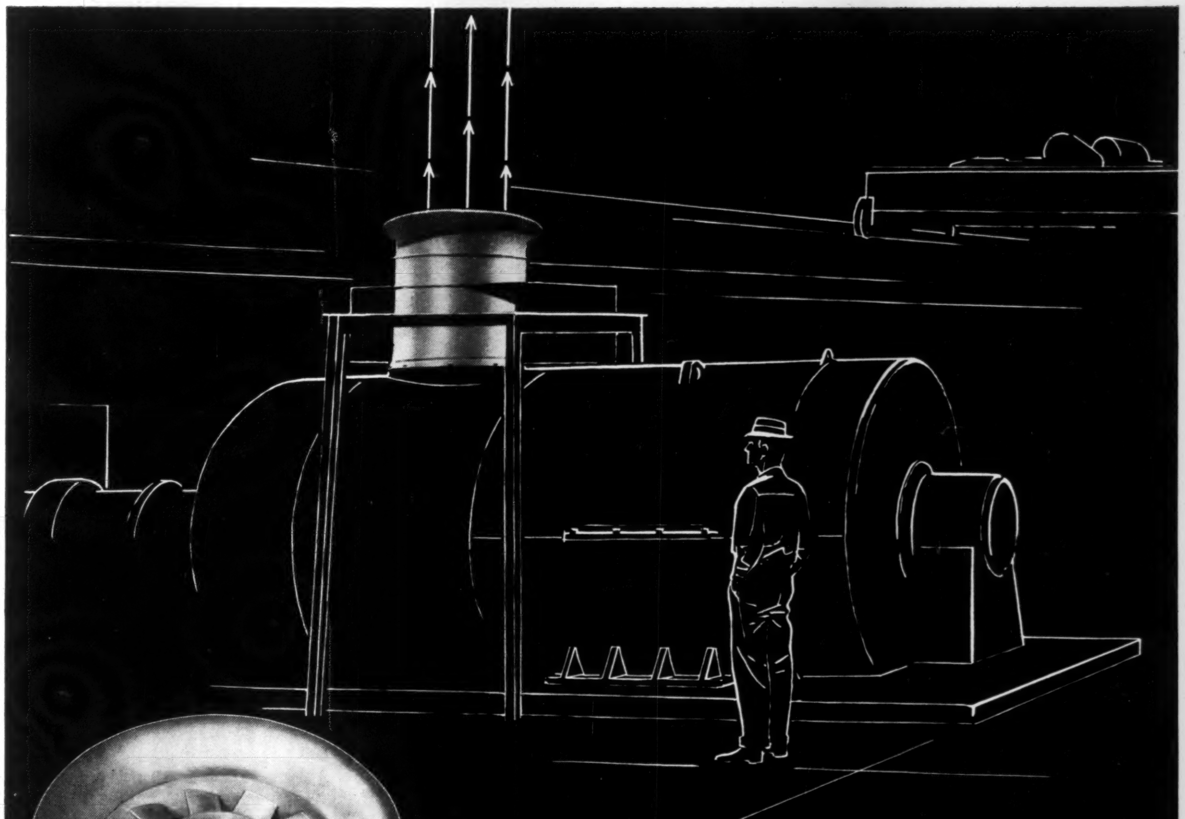

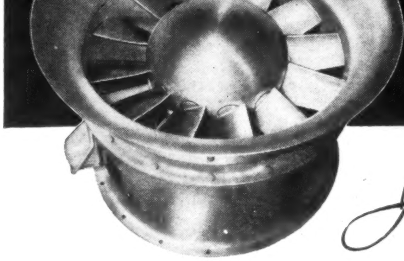

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THE JOB OF THIS JOY FAN is to cool a drive motor in one of the country's largest rolling mills . . . . good example of the adaptability of Joy fans to unusual ventilating applications.

BECAUSE of the in-line design of the Joy fans, no elaborate duct system was required . . . installation was simplified. Because a Joy fan is actually built around its motor, power-loss from motor to fan is negligible. Space requirements, as shown above, are at the irreducible minimum.

JOY AXIVANE FANS will show you new standards in efficiency, compactness, quietness, and outstanding versatility. Get the full story by writing to ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

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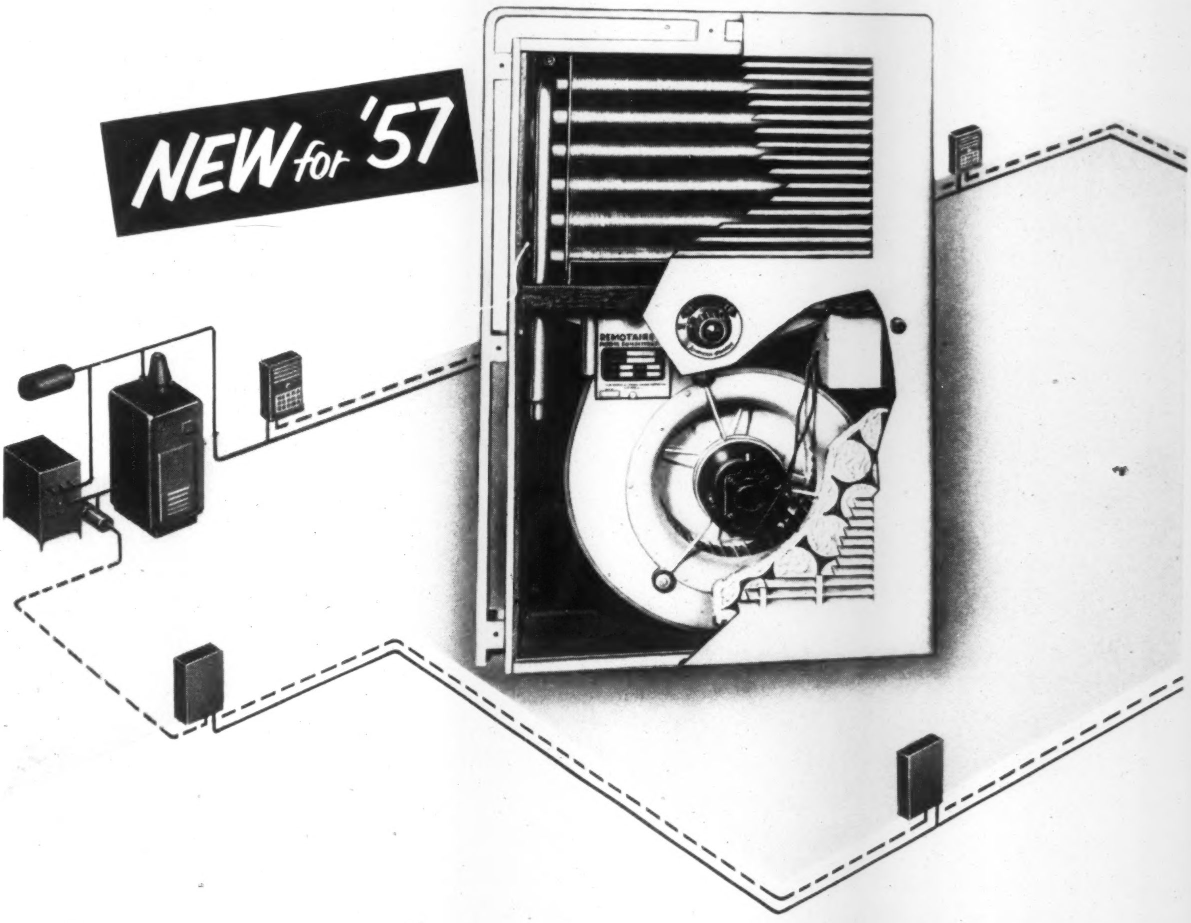

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Boiler—quality made of rugged cast iron for long, dependable, efficient service—easy-to-install, wet base construction—smartly designed gas or oil-fired models.

Chiller—compact, quality, packaged units. Air cooled models in 2 and 3 hp sizes. Water-cooled models in 2 to 125 hp sizes. Packaged feature provides for faster, easier, more compact installations.

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Year 'round central air conditioning system for motels, apartment and small office buildings, cools and heats with water...

- New Residential Remotaire system features customer-appealing individual room temperature control at no extra cost
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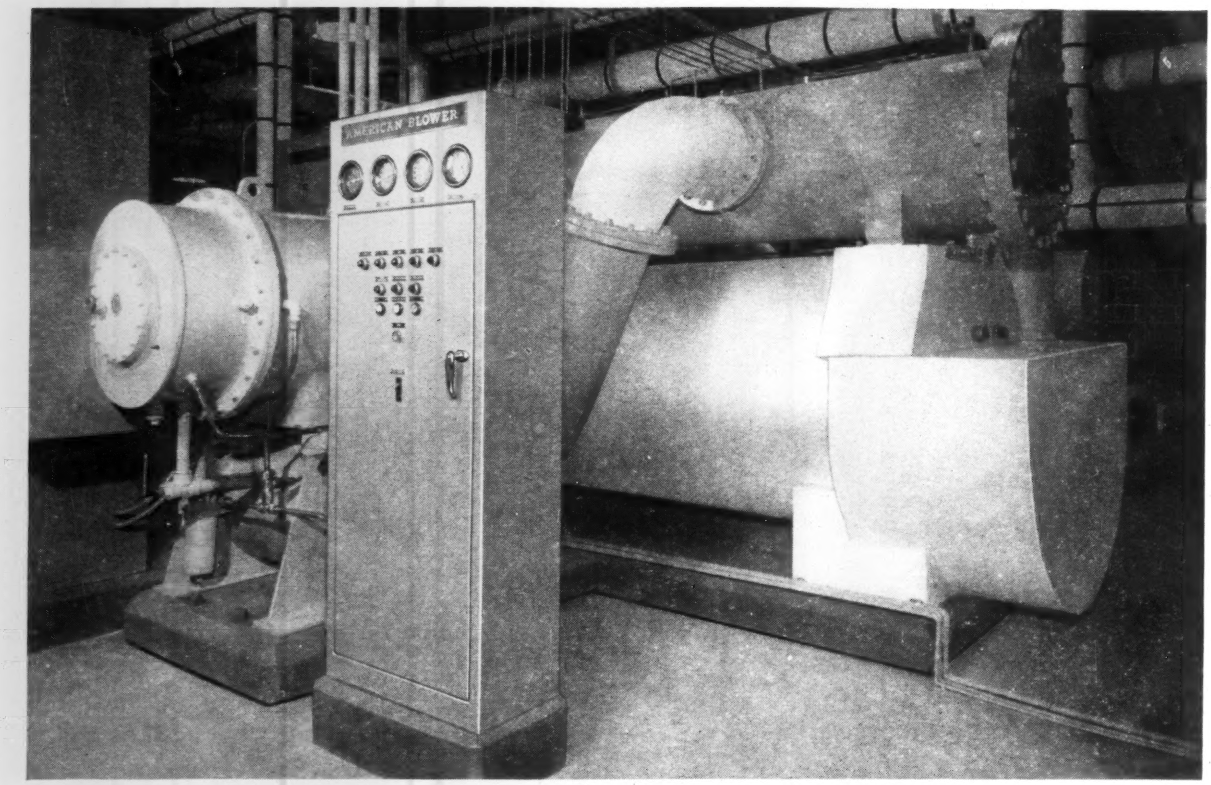


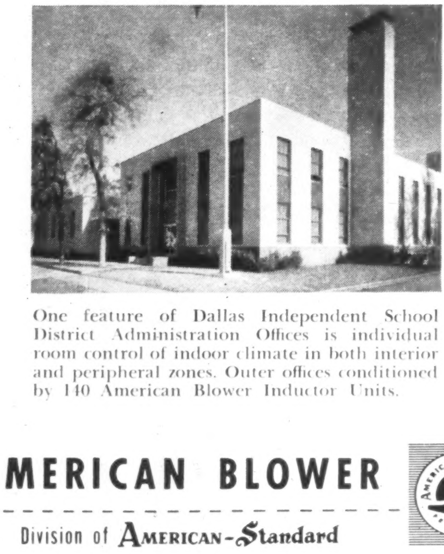
Dallas school-administration building's Tonrac adjusts itself immediately to fluctuations in air-conditioning load and weather.

Tonrac—air-conditioning nerve center in new Dallas school-administration building

To meet its growing educational needs, dynamic Dallas, Texas, is sponsoring a multimillion-dollar school-plant expansion program—a part of which is the modern addition to the school-administration building at right.

This streamlined structure is fully air-conditioned by American Blower. Nerve center for the system is the American Blower Tonrac® centrifugal refrigerating machine, which supplies chilled water to the various air-conditioning units. One of the reasons why American Blower air-handling and air-conditioning equipment was chosen, is because American Blower offered a *complete line* of quality equipment—designed, engineered, and manufactured to work together.

When your customer's plans call for air conditioning—call our nearest branch. American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.



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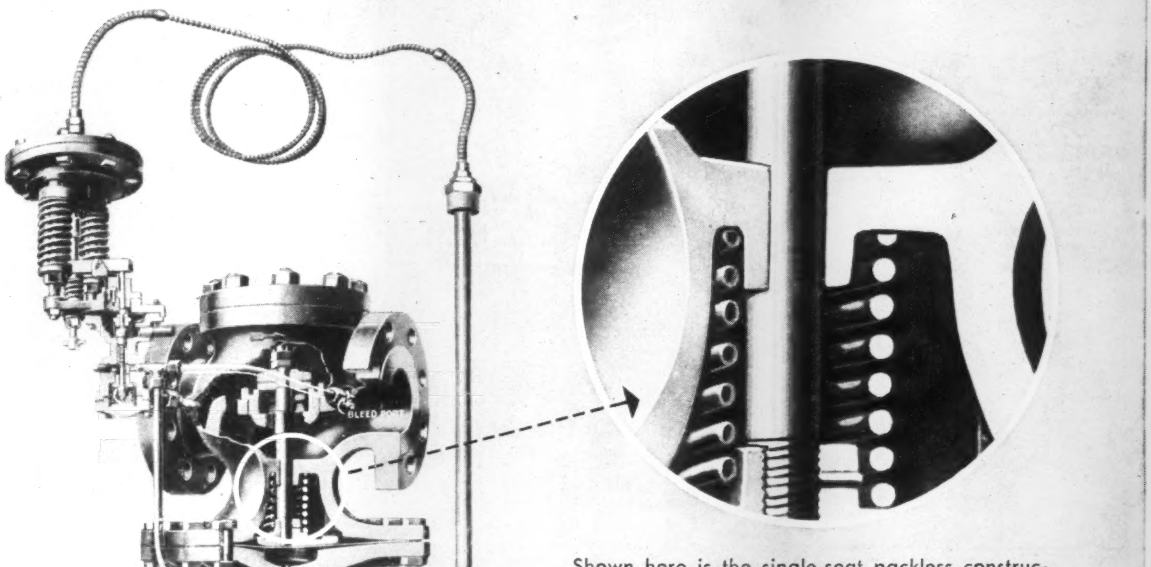
VALVE TIPS:

Advantages of Packless Construction in Temperature Regulating Valves



Shown here is the single-seat packless construction of the Spence ET150 Temperature Regulator.

One of the biggest headaches in regulating valve maintenance is repacking stuffing boxes.

How often a valve needs repacking, how much time it takes, and the cost of the system downtime all vary with the construction of the regulator and the service it's used for. No matter how you calculate all these variables it's still a headache—and an expensive one.

In the temperature regulator shown above (Spence Type ET150) stuffing boxes are eliminated. This is done by what is known as "balanced" diaphragm construction. You can see in the cutaway drawing that pressure is applied to both sides of the large metal diaphragm. The upper side is exposed to delivery steam pressure and the lower side is exposed to loading pressure applied by the pilot. When the pilot closes, both delivery pressure and loading pressure are equalized through the bleedport and connecting tubing.

This construction not only does away with repacking problems, but it makes possible additional savings as well. For example, you will note in the sectional blow-up that this design eliminates a closely fitted stem and guide. Dirt or other foreign matter doesn't have much of a chance to lodge between these parts and cause sticking.

Another cause of binding or sticking, uneven expansion of closely fitted parts, is also eliminated with this design. In addition, valve stem wear is reduced for the same reason.

Lower maintenance is not the only advantage of this packless construction. Accuracy of regulation is also improved because friction due to a stuffing box, dirt, or uneven expansion is not a problem. The large, *balanced* metal diaphragm is more sensitive to slight changes in pressure.

Guaranteed Not To Wiredraw

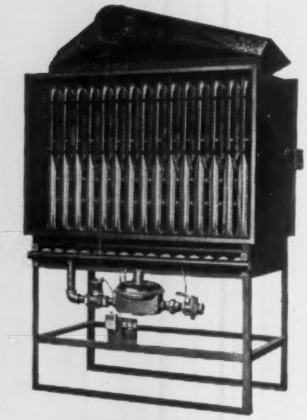
If seats and discs are cut by steam (wiredrawn) the loss of steam through these grooves can be another expensive item — directly charged against the regulating valve. Fortunately, you can eliminate these costly leaks by specifying a temperature regulator that is *guaranteed not to wiredraw*.

Spence makes such a guarantee because their seats and discs are made of SECO Metal. Over 20 years experience with this special alloy has failed to produce a single case where a SECO Metal seat or disc had been cut by steam. All that's required is an approved strainer located ahead of the regulating valve. Expensive steam leaks just can't happen with this combination of SECO Metal and single-seat design.

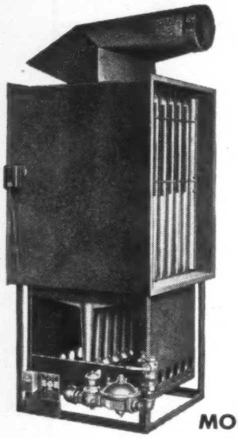
If you would like to have more information on Spence Temperature Regulators, drop us a line and ask for Bulletin T150. It gives more detailed information on these and other Spence design features. Piping layouts and helpful information on the installation of temperature regulators are also included. Write for your copy today.

SPENCE ENGINEERING COMPANY, INC.
Walden, New York

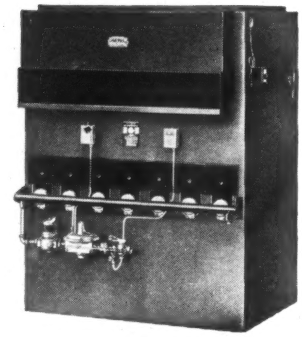
SE 140



MODEL SED-E



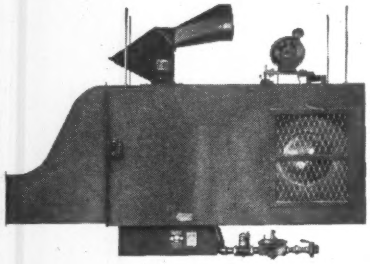
MODEL SED-S



MODEL SED-VF

MODEL SED-E — Non-corrosive type 321 stainless steel heat exchanger. Permits installation downstream of cooling equipment, for continuous blower operation. Air throughput in either direction. 80,000 to 600,000 Btu input.

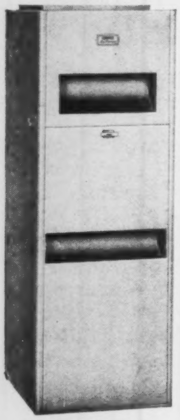
MODEL SED-S — Same as SED-E except controls are at the side, instead of at the end where accessibility requires either SED-E or SED-S is available in sizes from 80,000 to 600,000 Btu input in increments of 40,000 Btu.



MODEL SEU

MODEL SED-VF — Tested and approved as a duct furnace; type 321 stainless steel. Re-circulated or fresh air enters through bottom, sides, or back. Built-in air bypass, vent in front. Sizes from 70,000 to 245,000 Btu input.

MODEL SEU — Suspended unit heater. Recirculates room air. Diffuser outlet with adjustable vertical and horizontal vanes. Double inlet forward curve blower. Continuous duty, variable pitch drives, raised port burners. 80,000 to 600,000 Btu input.



MODEL SEC

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outstanding for
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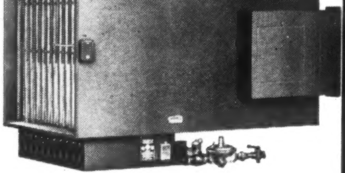

MODEL SES

MODEL SEC — Forced air furnace. Stainless steel heat exchanger sections seam and arc welded. One piece cast iron burners with drilled ports. Oversize double inlet blower, glass or washable filters. 6 sizes — 70,000 to 245,000 Btu input. For zero clearance.

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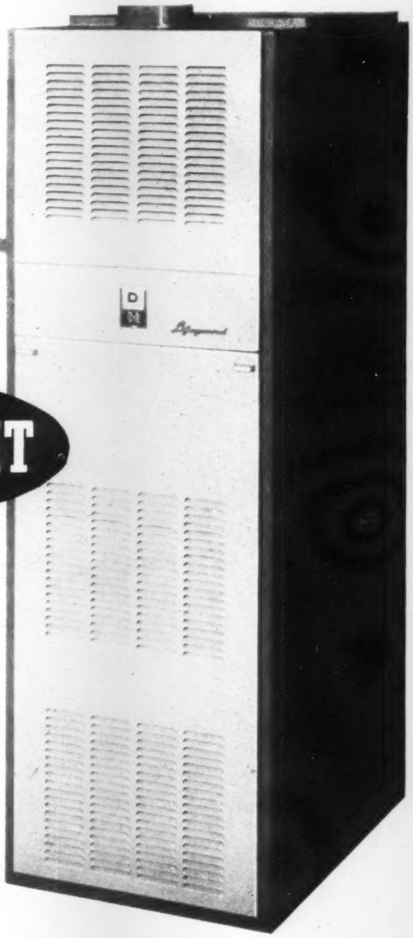
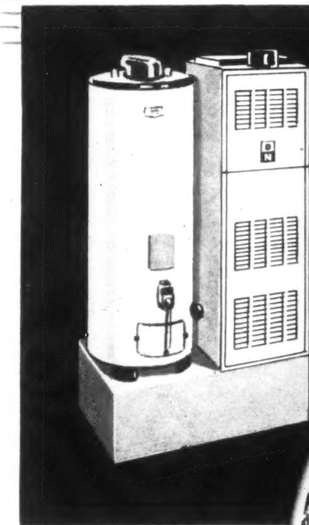
Noland & Co., Newport News, Va.
Temp-Control Corp., Portland, Oregon

MODEL SES—Forced air, suspended furnace for installation in suspended duct system. Inlet and outlet designed for sheet metal duct connection. Double inlet forward curved blower. Continuous duty variable pitch drives, raised port burners.

Conditioned Air for perfect comfort





*P*ossibly no Original Equipment Manufacturer has been more alert to its responsibilities and opportunities in the air conditioning field, than the manufacturers of Day and Night Lifeguard Forced Air Furnaces. They saw that the proper even distribution of conditioned air for year round comfort was a vital need.

MORRISON PRODUCTS, INC. have thoroughly enjoyed working with this firm in developing furnaces and air conditioning equipment of outstanding design and construction features.

Write for Blower Catalog Today

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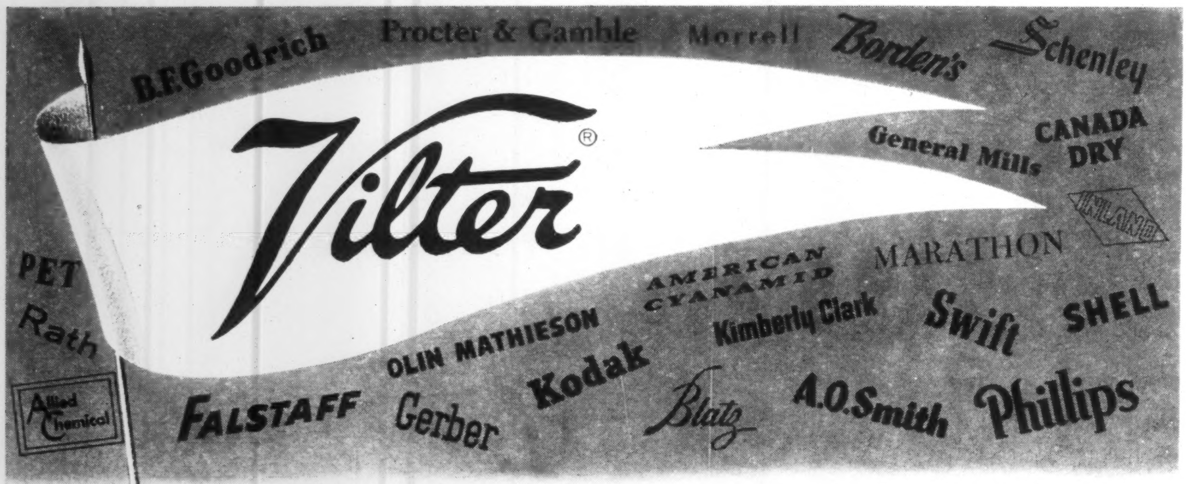
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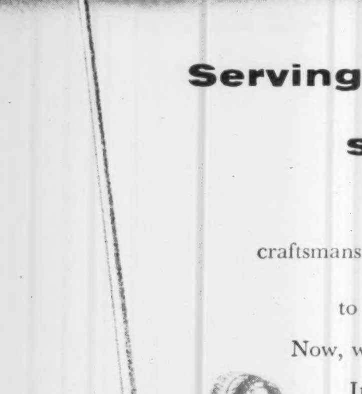

Serving the "500"* is a stimulating challenge to QUALITY

"SELLING" big business is a real challenge to our ingenuity, craftsmanship, engineering, and research. To sell to companies whose standards are always high demands constant alertness from us to improve our line of refrigeration and air conditioning equipment.

Now, what does this mean to the many users, big or small, of Vilter equipment?

It means sound engineering, equipment designed to do the required job, and more—it means sound metallurgy that provides metals that stand the strains and stresses of daily operation—it means careful workmanship that accepts no departure from rigid standards—it means sound application analysis that fits the product to the job—this is the Vilter code—this is the Vilter standard that has won the respect and business loyalty of thousands of customers the world over.

Dairies, meat packers, breweries, frozen food processors, chemical companies, hotels and many others have found the Vilter trademark synonymous with economical, dependable, year-in, year-out operation.

For a careful appraisal of your air conditioning or refrigeration needs, call on us to give you the analysis of your requirements and our recommendations as to the equipment that will best serve your needs.

* A large proportion of America's largest industrial corporations are Vilter customers as determined from the FORTUNE Directory of the 500 Largest U. S. Industrial Corporations, July, 1956.

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QUALITY CRAFTSMANSHIP that lasts...
ENGINEERING DESIGN that guarantees performance

REFRIGERATION 1867 1957 Vilter 90th Year AIR CONDITIONING

REFRIGERATION and AIR CONDITIONING

THE VILTER MANUFACTURING COMPANY, Milwaukee 7, Wisconsin

Air Units • Ammonia & Freon Compressors • Booster Compressors • Baudelot Coolers • Water & Brine Coolers • Blast Freezers • Evaporative & Shell & Tube Condensers • Pipe Coils • Valves & Fittings • Pakice & Polarflake Ice Machines

The most convincing stamp of user satisfaction

9 repeat orders for Sarco Heating Specialties

ANOTHER REPEAT ORDER FOR SARCO
CATERPILLAR

Engine factory of Caterpillar Tractor Co., Peoria, Ill. *Architects & Engineers:* Giffels & Vallet Inc., L. Rossetti Assoc., Detroit. *Heating Contractor:* The Stanley-Carter Co., Detroit.
Sarco heating specialties also are providing trouble-free service in Caterpillar's Joliet and Decatur, Ill. and York, Pa. plants.

...won by past performance at Caterpillar Tractor Co.!

SARCO heating specialties were first installed in a Caterpillar plant back in 1947.

Since that first order, Sarco heating specialties have been ordered an *additional nine times* for four Caterpillar plants — each repeat order is indicative of the confidence Caterpillar has in Sarco performance.

Today, more than 1800 Sarco steam traps in addition to other heating specialties give trouble-free service at four Caterpillar Tractor Co. plants.

Architects, engineers and heating contractors appreciate this kind of dependability. It assures them complete user satisfaction, protects reputations, eliminates trouble-some call-backs. Why not specify Sarco on *your* next job?

For full information on all Sarco products, write Sarco Co., Inc., Empire State Bldg., New York 1.

America's Industrial Leaders Repeatedly Order Sarco Heating Specialties

- Aluminum Co. of America
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- Ford Motor Company
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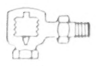
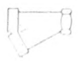
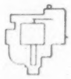
SARCO *saves steam*

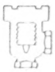
STEAM TRAPS • TEMPERATURE CONTROLLERS • HEATING SPECIALTIES


Radiator Valves • Traps


Strainers

Float-Thermostatic Traps


Camlift Bucket Steam Traps


Thermostatic Traps

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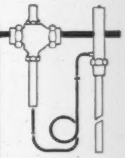
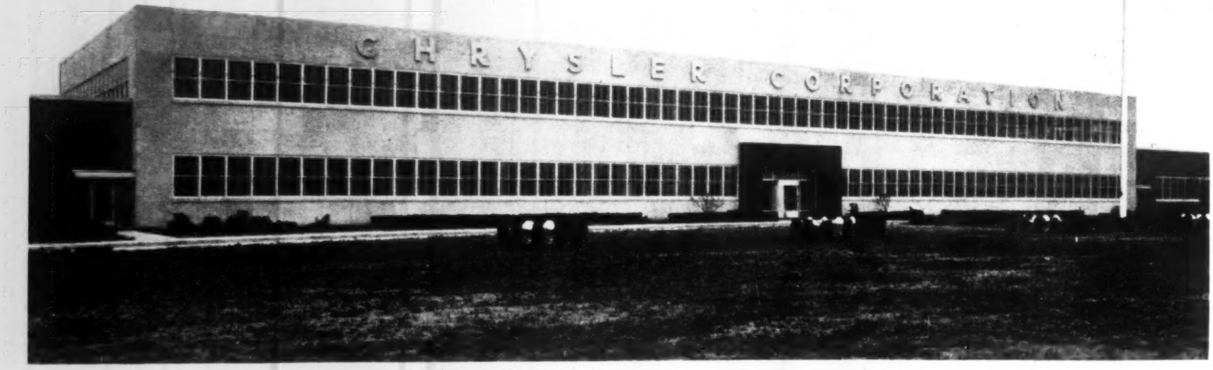

Self-Operated Temp. Reg.

Chrysler Torque Flite Automatic Transmission Plant, Kokomo, Indiana. Architects and Engineers: Albert Kahn Associated Architects & Engineers, Inc., Detroit, Michigan; Mechanical Contractor: Freyn Bros., Inc., Indianapolis, Indiana.

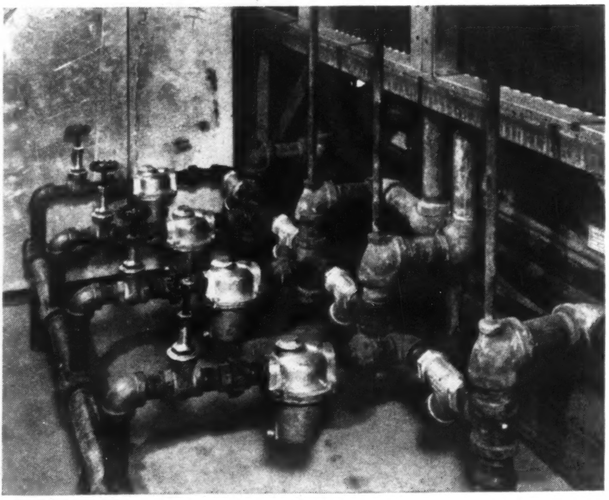


Heating specialties by illinois in new Chrysler transmission plant!

Nothing but the very finest job-tested equipment was installed in Chrysler Corporation's huge new Torque Flite automatic transmission plant at Kokomo, Indiana. This held true for the smallest steam trap as well as the largest heat treating furnace.

The photo at right shows a typical installation of Illinois Engineering products at the Chrysler plant. In this case, four float and thermostatic traps are trapping condensate from steam heating coils used in the supply air system.

24-hour delivery, 50-year durability—two *good* reasons for specifying Illinois traps. Select from a complete line of thermostatic traps, float and thermostatic traps and steam traps—25 inches vacuum to 600 lbs. pressure. Write for Bulletin 110.



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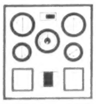
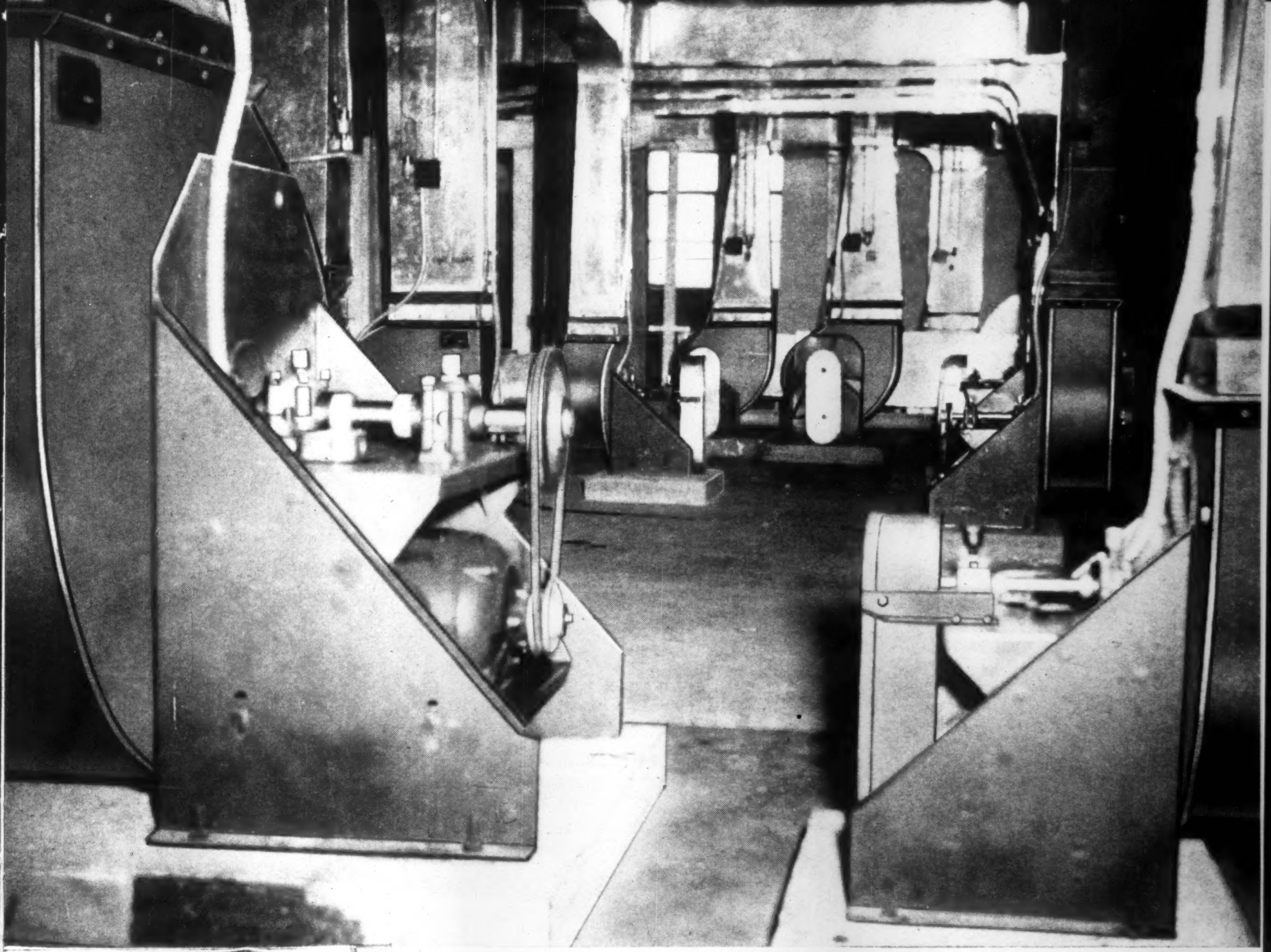


Selectotherm Control Systems



"BUFFALO" BELTED VENT SETS

VARYING SYSTEM REQUIREMENTS?

USE THESE VERSATILE PACKAGE FANS

Where you need wide flexibility in a large system — in widely varying zones — or independent small systems — "Buffalo" Belted Vent Sets are your answer. Light, compact "packages", they are easily and inexpensively installed in multiple units as shown above — and capacity of each fan may be readily changed after installation.

Available in capacities from 500 to 20,000 cfm, Belted Vent Sets have the "Q" Factor* features of the largest and finest "Buffalo" Fans — inlet guide vanes, backward curve blades, factory-balanced rotors, the Limit-Load® non-overloading characteristic. Available also with special features for fume hood exhauster, for induced draft service on small boilers handling gases less than 600 F. Write for Bulletin 3720-A, describing these quiet, efficient units.

The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life, in every "Buffalo" product.

VENTILATING

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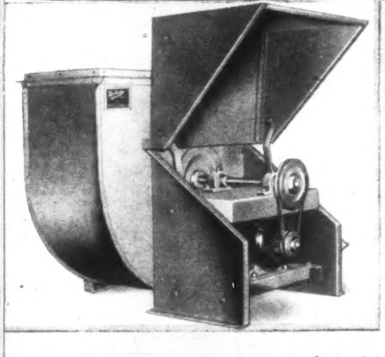

ASILY VARIABLE CAPACITY — note adjustable
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nodel has all-weather drive cover for out-
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UILT-IN EFFICIENCY of "Buffalo" Belted Vent
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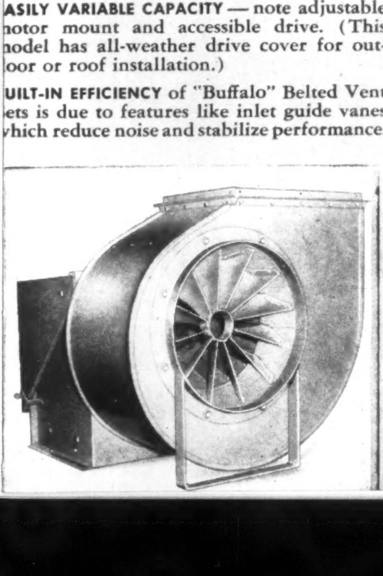
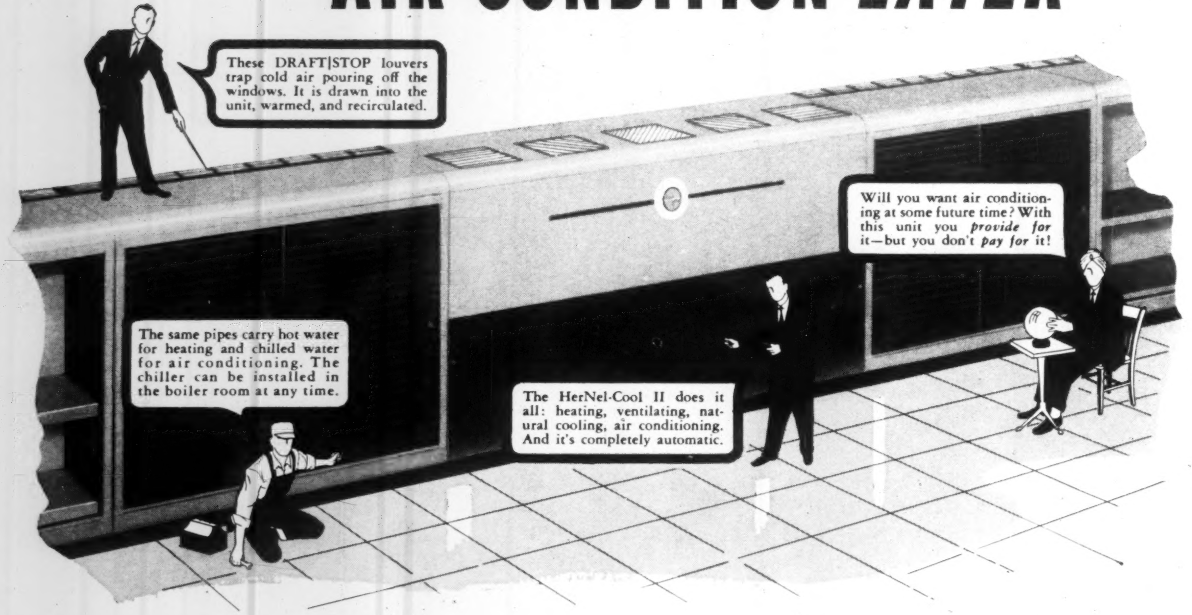
vhich reduce noise and stabilize performance.



New HerNel-Cool II Unit Ventilator... by Herman Nelson

INSTALL IT *NOW*...
AIR CONDITION *LATER*


These DRAFT|STOP louvers trap cold air pouring off the windows. It is drawn into the unit, warmed, and recirculated.
Will you want air conditioning at some future time? With this unit you *provide for* it—but you don't *pay for* it!
The same pipes carry hot water for heating and chilled water for air conditioning. The chiller can be installed in the boiler room at any time.
The HerNel-Cool II does it all: heating, ventilating, natural cooling, air conditioning. And it's completely automatic.

Your new school's heating and ventilating system can be as modern as tomorrow—*and stay that way*—if you plan around the new HerNel-Cool II!

Every essential for classroom comfort, including air conditioning, is provided in this "last word" system.

Check these features—only the HerNel-Cool II offers all of these:

1 *Flexible air conditioning:* The same pipes which carry hot water for cold weather heating carry chilled water for summer air conditioning. All you need is a chiller in the boiler room. It can be provided initially or at any future time. Whenever air conditioning is desired, you can have it with a minimum of expense.

2 Famous DRAFT|STOP* *method of controlling window downdrafts* without adding to the classroom heat load. Cold window drafts are trapped, drawn into the unit, then warmed and gently circulated.

3 Circulating *hot water* for heating—with either wall-hung, cabinet-base, or recessed-edge perimeter piping. The most flexible, most economical heating system there is. HerNel-Cool II heats only when heat is needed.

4 *Completely automatic individual room control* for true comfort in every season. The HerNel-Cool II "thinks for itself" and provides rapid heat, air for ventilation, or air for natural cooling as the room requires. In hot weather, when outside temperatures soar, it switches automatically to mechanical cooling.

A HerNel-Cool II system fits into today's school budget . . . but its benefits will be enjoyed for many years to come. Today—or twenty years from today—pupils will be alert and comfortable from the opening of school to the closing bell. Teachers will be free to concentrate on *teaching*—in an atmosphere that's conducive to *learning*.

Want more facts? Ask your Herman Nelson representative or write to Herman Nelson Unit Ventilator Products, American Air Filter Co., Inc., Louisville 8, Ky.

**Patented, there are no substitutes.*

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UNIT VENTILATOR PRODUCTS
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System of Classroom Cooling, Heating and Ventilating

Specify RECO

Boiler Plant, West Wing and Mercy Hall — St. Mary's Hospital, Knoxville, Tenn.

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Architects—David B. Liberman, Knoxville, Tenn.—Maguolo & Quick, Cincinnati, Ohio.

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Hot Water Treatment by RECO for St. Mary's Hospital

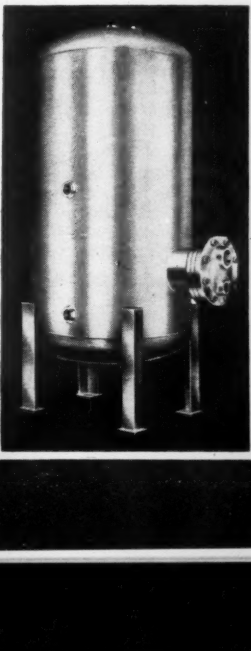
When it comes to hot water, a hospital really pours it on. That's why the consulting engineer "prescribed" RECO water heating equipment for the new buildings at St. Mary's.

The complete RECO installation includes convertors, storage heaters, expansion and bulk storage tanks. 17 units in all . . . Guaranteed to keep plenty of rust-free hot water always on tap.

If you're interested in guaranteed top quality heat exchange equipment—delivered quickly and priced right—SPECIFY RECO on *your* next heating job.

Write for free catalogs plus name of nearest RECO representative.

Dept. N, Richmond Engineering Co., Inc., 7th & Hospital Sts., Richmond 5, Va.



RICHMOND ENGINEERING CO., INC.

"FREON"* REFRIGERANTS IN AIR CONDITIONING

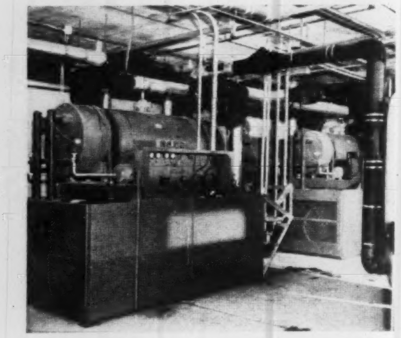
Field Reports About Successful Installations

•

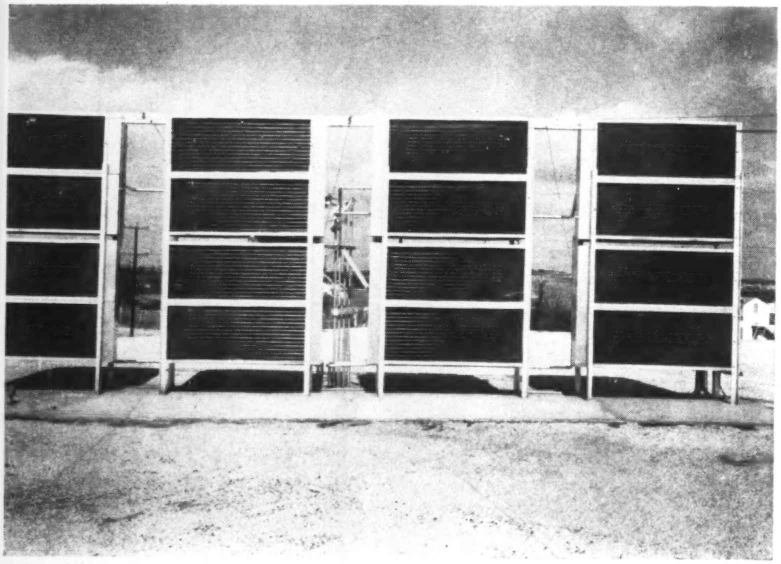
Air-cooled condensers maintain 62½-ton refrigeration load

Air-cooled condensers serving 19 compressors provide 62½ tons of refrigeration for showcases and store rooms at Handy-Andy Community Store No. 2 in San Antonio, Texas.

Five Kramer-Trenton Unicorn condensers, located in the basement, use 13,600 cubic feet of forced ground air per minute. They cool the "Freon-12" refrigerant that protects large and costly stocks of perishables. The 19 Brunner compressors (part of which are shown above) are from ¾ to 5 hp.



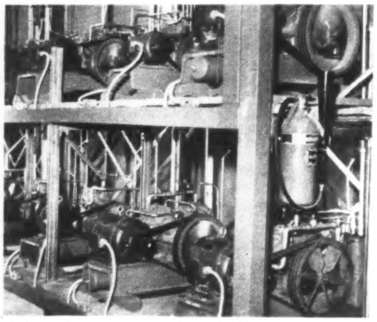
Air conditioning and refrigeration together account for a total of 162½ tons carried by air-cooled condensers at Handy-Andy. Advantages reported for this method of cooling refrigerants include savings in condenser descalation costs, and conservation of public water supplies in a rapidly growing community.



100-ton system with air-cooled condensers cools San Antonio supermarket

Roof-mounted condensers (above) cool "Freon-12" refrigerant in the 100-ton air conditioning system at Handy-Andy Community Store No. 2, San Antonio, Texas.

Fans draw 27,200 cubic feet of air per minute through the Kramer-Trenton Unicorn condensers. Compression is supplied by four twin-mounted Brunner units (below, right) in the store's basement. Result is effective air conditioning throughout 43,000 cubic feet of floor space—even when outside temperatures exceed 100°F. The 100-ton air conditioner is believed to be the nation's largest single installation using air-cooled condensers.



To Handy-Andy management, important maintenance advantage of the air cooling method is the saving in condenser descalation costs. Equally important to a center of growing population like San Antonio: such condensers place no added burden on public water supplies.

•

You can specify a FREON* refrigerant for any air conditioning or refrigeration application

Effectiveness of air conditioning and refrigeration at Handy-Andy is due in part to the charge of "Freon-12" refrigerant in the cooling system. No component of the cooling system is more important than the refrigerant. That's why you should always specify "Freon" for the jobs you do.

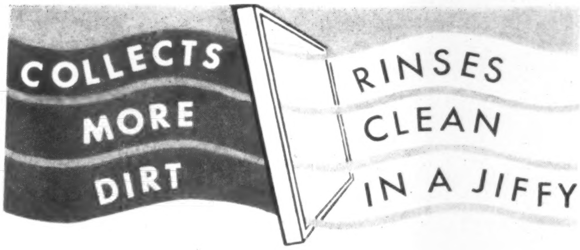
You can be sure "Freon" refrigerants will never give you any trouble from acids or moisture. "Freon" refrigerants are safe—nonflammable, nonexplosive, virtually nontoxic. Your wholesaler can promptly supply a "Freon" refrigerant for any size or type of air conditioning or refrigeration application.

For more information or technical data on uses of "Freon," write to E. I. du Pont de Nemours & Co. (Inc.), "Kinetic" Chemicals Division 73, Wilmington 98, Delaware.

DU PONT REG. U.S. PAT. OFF. **FREON REFRIGERANTS**

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

"Freon" is Du Pont's registered trademark for its fluorinated hydrocarbon refrigerants.



Install **DUST-magnet®** *lifetime* electrostatic air filters

Dust-magnet air filters are standard equipment on leading makes of air conditioners, commercial refrigeration units and warm air furnaces . . . convincing evidence that Dust-magnet is tops in its field. You can be proud to sell and install Dust-magnet because this filter collects more dirt, and lasts for the life of the equipment.

No sticky coating. Dust-magnet quickly rinses clean, goes back into service immediately. U. L. approved. Ask your jobber about Dust-magnet or write for details.

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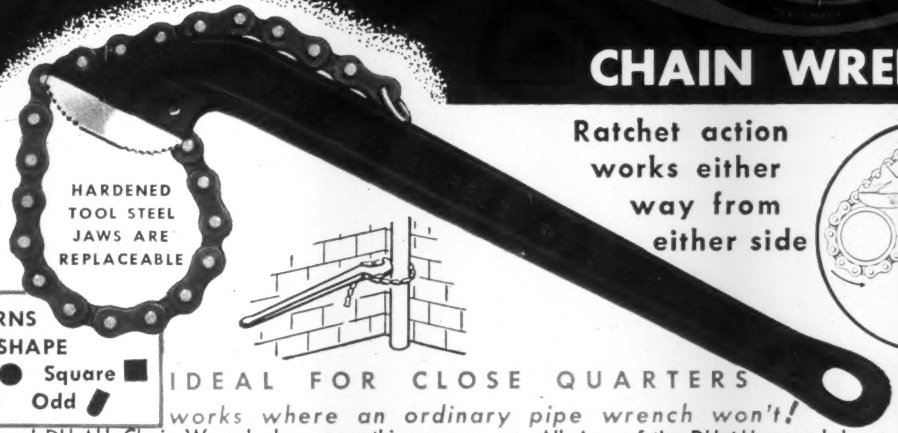
VALVE POSITION INDICATORS

HAND WHEELS FOR DIAL INDICATING
HAND REGULATING VALVES

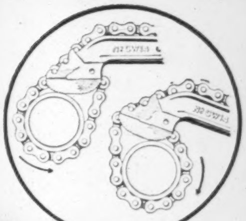
Tejax valve position indicators give precise settings, enabling operators to return to exact settings, without guesswork, when duplicate results are desired.
Thousands are installed in industrial plants in all parts of the world . . . proof of quality. Write now for more information.

TEJAX ENGINEERING CORP.
P. O. Box 348 Pawtucket, R.I.

Everybody NEEDS THIS NEW REED CHAIN WRENCH



Ratchet action works either way from either side



TURNS ANY SHAPE
Round ● Square ■
Hex ⬢ Odd

IDEAL FOR CLOSE QUARTERS

works where an ordinary pipe wrench won't!

The Reed DU-ALL Chain Wrench does everything a conventional pipe wrench will do, and a great deal more. It gets into tight corners, close to baseboards or between parallel pipe lines, and holds round, square or irregular shapes . . . firmly, without "play" or crushing.

Its fast, ratchet action lets you tighten and "back off" without taking the wrench from the pipe.

All sizes of the DU-ALL wrench have ample chain length for fully tightening pipe up to the diameters handled by ordinary wrenches of equal lengths. Additional chain in the 14″ model, however, gives the wrench a full working capacity up to 2″ pipe and a holding capacity up to 4 inches. This is a major convenience in lining up soil pipe stacks, straightening studs, setting posts or turning any irregular shape within the leverage range of the 14″ handle.

Whenever you want to work with pipe . . . ask for a REED Pipe Tool!

REED MANUFACTURING COMPANY • Erie, Pennsylvania

VIBRATION ELIMINATORS

Because freedom from leaks in refrigerant lines is so important . . .

Nitrogen–under pressure–searches for leaks in every American Vibration Eliminator

WHEN YOU INSTALL AN AMERICAN VIBRATION ELIMINATOR, IT'S LEAKPROOF AND PERMANENT. HERE IS WHY.

Each American VE is tested in tanks such as the one shown above—under pressure and under liquid at the same time. Searching nitrogen—under pressure—shows up the tiniest leak. When the unit is found *absolutely* free of leaks, then—and only then—we dry the VE in a special oven and prepare it for shipment. After dehydration, VE's are sealed in airtight polyethylene bags covering the whole unit.

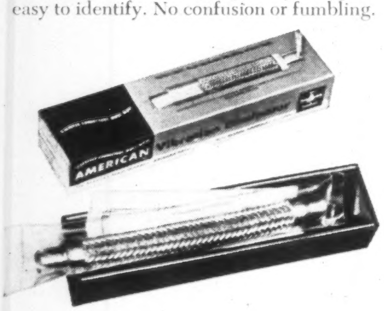
YOU CAN USE AMERICAN VE'S WITH CONFIDENCE BECAUSE—

The right metal does the job. The special tin-bronze alloy—the result of American Brass metallurgical know-how—is tailored for the refrigeration and air conditioning industries.

Double bronze braid where extra protection is needed. On all American VE's 2⅝" O. D. or larger.

Clean, dry, tested, protected. Snip the end of the vaporproof polyethylene bag and you have a factory-fresh unit to install in the line . . . clean, inside and out!

Packaged for your convenience, protection. The new boxes are sturdy, easy to open, easy to identify. No confusion or fumbling.



NOW listed by Underwriters' Laboratories through sizes 3⅝" O. D.

For descriptive folder write: The American Brass Co., American Metal Hose Division, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Co., Ltd.
56212

WHEREVER CONNECTORS MUST MOVE

AMERICAN

For American Vibration Eliminators see your

ANACONDA®

DISTRIBUTOR

Herbert Hoover Junior High School, San Francisco. *Mechanical Contractor:* Anderson and Rowe, Inc.; *Pipe Jobber:* P. E. O'Hair and Co.

Junior High in California . . . Office Building in South Carolina

Both have Beth-Co-Weld Piping

These two new buildings, one a junior high school in California, the other a 10-story office building in South Carolina, have hundreds of feet of Beth-Co-Weld Steel Pipe in their plumbing and heating systems.

In city after city the story is the same. Whether new construction is large or small, Beth-Co-Weld is the popular choice with many contractors. This is because Beth-Co-Weld is a quality pipe, made by the continuous-weld process. It's strong and sound; and it's economical because it's so easy to work.

Beth-Co-Weld comes in a wide range of sizes, enabling you to meet virtually every requirement. In diameters from ½ in. to 4 in. it is furnished in standard weight; it also comes extra-strong in diameters from ½ in. to 3 in. Both weights are furnished in 21-ft lengths, plus or minus 1 in., as well as in random lengths. Specify Beth-Co-Weld for your next job.

SECURITY FEDERAL BUILDING

Security Federal Building, Columbia, S. C. *Plumbing and Heating Contractor:* W. O. Blackstone & Co.; *Pipe Jobber:* Noland Co., Columbia Branch.

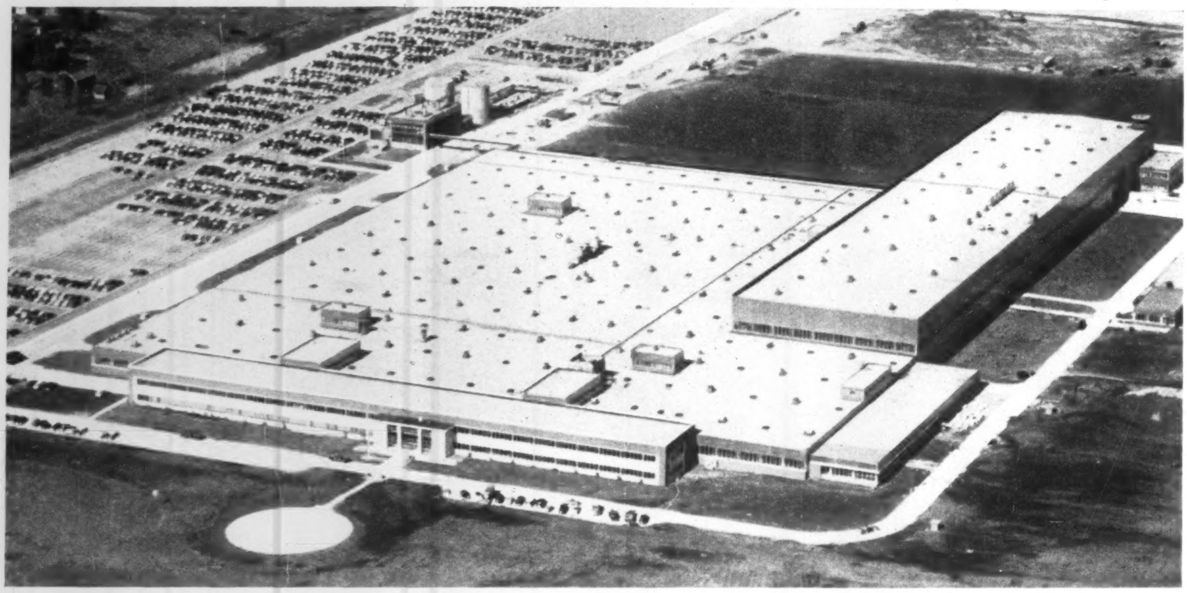
BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

For Sikorsky's new 18-acre plant . . .



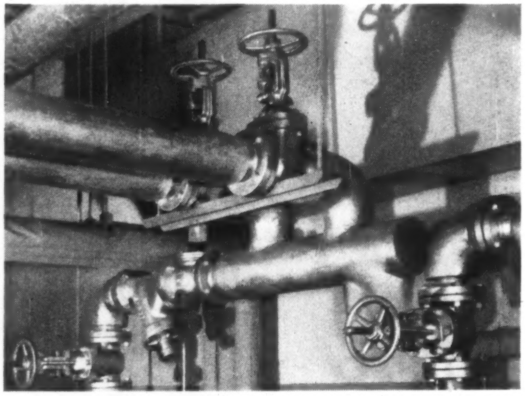
Architects and Engineers: F. A. Fairbrother and George H. Miehls, Detroit; with Albert Kahn Associated Architects and Engineers, Detroit, as consultants.
General Contractor: E. & F. Construction Co., Bridgeport.
Mechanical Contractor: John Winkle, Inc., Larchmont, N. Y.

Where reliability is the watchword **JENKINS VALVES** were selected

Reliability has characterized Sikorsky Helicopters throughout a long record of military and commercial service. A watchword in the building of these versatile airplanes, *reliability* also was made the critical measure of all equipment for the 18-acre Sikorsky plant recently completed in Stratford, Conn.

On the valves to control much of the complex network of pipelines, management, architects, engineers and contractors found it easy to agree. From long experience on many jobs all could be sure of the reliability of Jenkins Valves.

This confidence in the specification "Jenkins", has been shared by building experts and plant operating men alike for 93 years. The valves that have won this great confidence bear the Jenkins Diamond trademark . . . and *they cost no more.* Jenkins Bros., 100 Park Ave., New York 17.



JENKINS VALVES shown controlling heating lines. Used throughout the Sikorsky plant on steam, water, air and process piping.

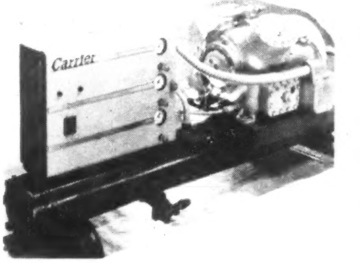
JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES SINCE 1864 TRADE JENKINS MARK

Jenkins Bros

Sold Through Plumbing-Heating and Industrial Distributors

EQUIPMENT DEVELOPMENTS . . .

For reviews of Recent Trade Literature see Page 238



Hermetic Compressors . . .

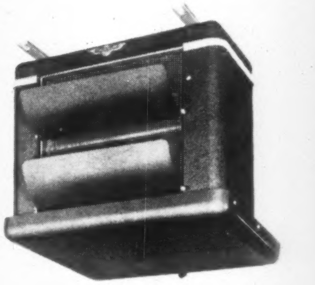
. . . in new line ranging 10 to 60 hp—*Carrier Corp., Dept. HPAC, Syracuse 1, N.Y.*

Reciprocating units designed to reduce cost, size, weight of air conditioning installations in this size range. Units are said to be vibrationless, noise-free in operation. Mounted on vibration isolators when installed on top of condensers. Shown is 15 hp model.

Unit Ventilator . . .

. . . in new direct gas fired model for schoolroom applications—*Herman Nelson Unit Ventilator Products, American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville.*

"Univent" is said to combine advantages of unit ventilation with advantages of direct fired gas unit. Recommended by company for remodeled classrooms, portable buildings, additions to temporary schools. Damper automatically positions itself to bring in up to 100 percent outdoor air, says manufacturer. In four models with maximum ratings 76,800 to 179,200 Btu per hr output, using city or LP gas.



Unit Air Coolers . . .

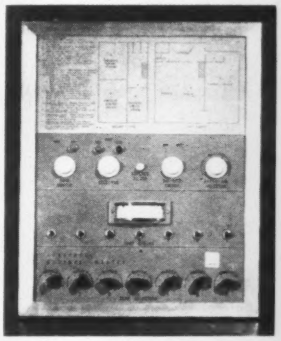
. . . line expanded to include new "Model MT-320" with 32,000 Btu per hr capacity at 10 F temperature difference—*Larkin Coils, Inc., Dept. HPAC, 519 Memorial Dr., S.E. Atlanta 1.*

Other features of redesigned standard "Humi-Temp" units include: model numbers now designate capacities, which have been changed to balance standard compressor capacities; number of fans in large capacity units has been reduced from three to two; bolted construction permits easy access to parts; case is constructed of heavier gage aluminum.

Draft Regulators . . .

. . . for heavy duty commercial service—*Wm. Steinen Mfg. Co., Dept. HPAC, 45 Bruen St., Newark 5, N. J.*

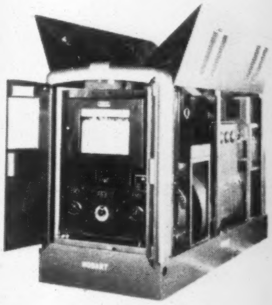
In 12, 14, 16, 18, 20, 24, 28, 32 in. sizes. Equipped with universal mounting collar for either screw or strap type mounting. Cited feature is custom built accuracy, with gate balance locked in at factory. "Acro-Lok," as feature is called, is said to be tamperproof.



Central Control Panel . . .

. . . for smaller buildings—*Minneapolis-Honeywell Regulator Co., Dept. HPAC, Wayne and Windrim Aves., Philadelphia 44.*

Designed so that nontechnical personnel can control comfort in small commercial or industrial buildings. Midget "supervisory centers" custom-built for theaters, restaurants, clubs, small stores, other establishments that have multiple temperature control areas but do not employ operating engineer. Instructions printed on panel and lights signal when various equipment is in operation, says company.

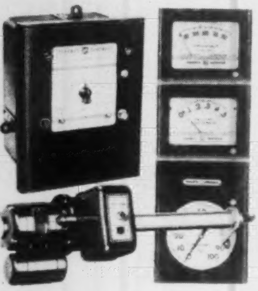


Induction Heating Unit . . .

. . . designed to provide advantages to weldors with savings of time, trouble, money—*Hobart Bros. Co., Dept. HPAC, Troy, Ohio.*

400 cycle unit permits preheating, stress relieving to be carried out

economically in one continuous cycle without necessity of moving weldment for furnace treatment or other operation, says company. Employs strip chart proportional program controller. Is said to be adjustable to any schedule of heating, soaking, cooling rates, and, when preset to particular program, provide automatic, continuous control of temperature during processing.



Draft Control . . .

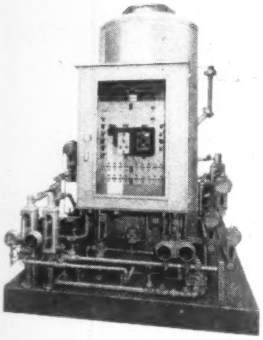
. . .instruments engineered to provide high combustion efficiency of gas, oil or stoker-fired equipment—*General Controls Co., Dept. HPAC, 801 Allen Ave., Glendale, Calif.*

With cast aluminum cases which permit flush or surface mounting. Automatic system is said to provide close control of overfire draft to reduce losses of useful heat. Draft program control, in conjunction with modulating damper actuator, maintains correct draft for all firing conditions, assures safe starting by opening uptake damper prior to burner ignition, says company.

Room Air Conditioners . . .

. . .available in new 1957 line—*Frigidaire Div., General Motors Corp., Dept. HPAC, Dayton 1, Ohio.*

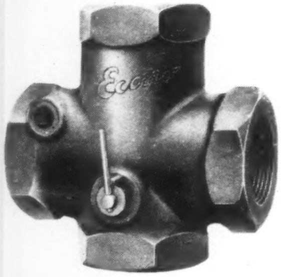
Units feature "simplified comfort" with new compact design permitting easy installation, simple operation, "draftless" circulation of conditioned air, says company. Seven window units with cooling capacities ½ to 1½ hp included in "Super" and "DeLuxe" series.



Ion Exchanger . . .

. . .available as mixed-bed unit preassembled for connection to water supply—*Illinois Water Treatment Co., Dept. HPAC, 840 Cedar St., Rockford, Ill.*

Is said to process water to high degree of purity. "IonXchanger" available in sizes suitable for most low-makeup power plants. Unit consists of mixed-bed column or tank, with external and internal piping, mounted on heavy welded steel base. Automatic operation provided by motor operated valves, controlled by conductivity metal and program timer. Vessels, piping included.



Flow Valve . . .

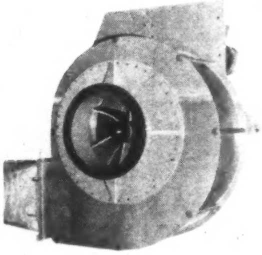
. . .for hot water heating systems—*Econo Products Co., Dept. HPAC, East Haddam, Conn.*

"6-Way" unit may be installed horizontally or vertically, as straight-through valve, or as angle valve using bottom inlet and side outlet or with side inlet and top outlet. May also be used as manifold flow valve by utilizing side inlet and side and top outlet, or using bottom inlet with top and side outlet. Using pipe plugs in outlets not required permits complete flexibility of installation, says company. In 1, 1½ in. sizes.

Sump Pumps . . .

. . .in four models with brass, aluminum, or cast iron construction *Wire Products Co., Dept. HPAC, 2115 E. Baltimore St., Baltimore 31.*

Company's "Heavy" series has models with outputs to 3600 gph. Cited features are: 1/3 hp motors; specially designed, heavy duty, double-pole sump pump switches; spring type flexible couplings; stainless steel and bronze wearing surfaces; bottom water entrance; large strainer area.



PVC Centrifugal Blower . .

. . .with 15,000 cfm capacity—*Industrial Plastic Fabricators, Inc., Dept. HPAC, Endicott St., Norwood, Mass.*

"No. CB-10M" has 10 in. diameter. Recommended by company for expelling corrosive air, fumes. Blower impeller wheels have back curve, non-overloading characteristics said to maintain high efficiency.

Torch . . .

. . .designed to provide high volume of heat at high flame temperature—*Prepo Corp., Dept. HPAC, Edgerton, Wis.*

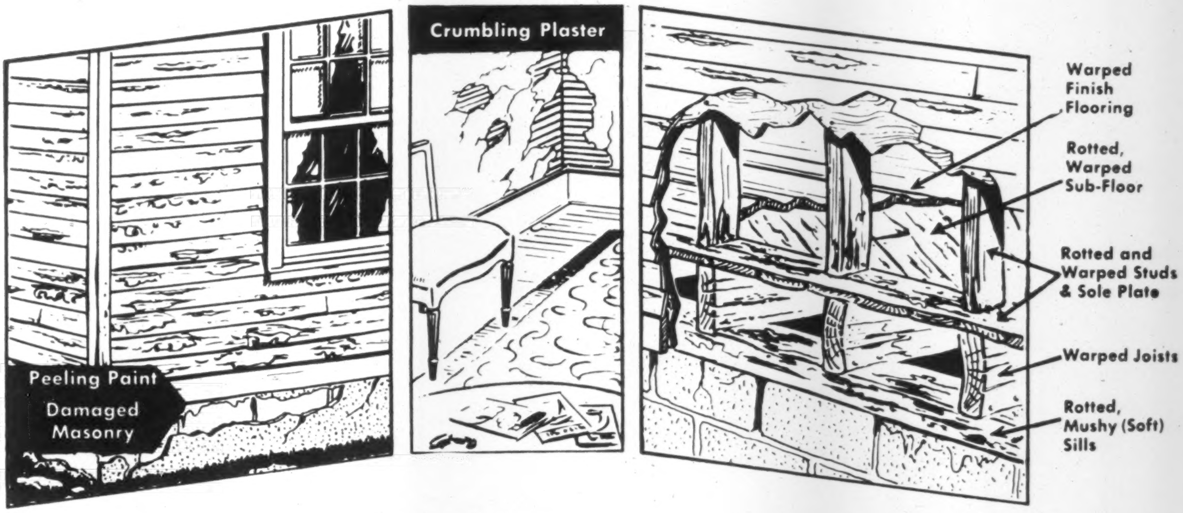
Develops flame temperature of 2700 F, says company. Burner design incorporates preheating device which is said to raise temperature of gas to 1000 F before it enters combustion chamber.

Self Contained Seal . . .

. . .for use on jet water pumps, oil pumps, reduction units—*Garlock Packing Co., Dept. HPAC, 400 Main St., Palmyra, N.Y.*

Can be used on any rotating shaft

More Destructive than Termites!



CONDENSATION WILL MAKE PAINT PEEL, PLASTER CRUMBLE, WOOD ROT, AND MASONRY AND MORTAR DETERIORATE.

Insulation which is not protected by an adequate vapor barrier can allow considerable water vapor to flow into ceiling, wall and floor spaces, where if it condenses it may cause damage. It causes millions of dollars in repair bills annually. Vapor is a gas with 1/205,000 the density of water at 32°F. It flows from high vapor density areas to low.

Cold air can retain less vapor in suspension than warm air, and hence is an area of low vapor density. Vapor flows through plaster, wood, brick, stone, asphalt, building paper, and ordinary non-metallic building materials, in the direction of the least dense vapor area, usually the coldest. When it touches here a substance colder than the dew-point of the air which holds it, vapor condenses.

Condensation stimulates the growth of fungi and insects which greedily break down wood and cause timber rot. It causes paint to peel, plaster to crumble, iron to rust.

HOW TO MINIMIZE CONDENSATION

Almost impervious to vapor, scientific multiple aluminum also retards condensation-formation. The slight mass of the aluminum foil on the warm side (1/5 oz. per sq. ft.) quickly approximates the adjacent air's temperature (by conduction), and so can extract very little heat from the air. Therefore the adjacent air on the warm side remains warm and can retain its vapor content in suspension, avoiding condensation formation. On its colder side, the aluminum foil is slightly warmer than the air adjacent to it. Since heat flow in conduction is from warm to cold, the added warmth enhances the ability of this air to hold more vapor without condensing.

DRASTICALLY RETARDS HEAT FLOW

The aluminum surfaces have a high 97% reflectivity to heat rays; a low 3% emissivity. The foils also reduce inner and outer convection. Conduction is slight through the preponderant, low density air spaces.

The U. S. National Bureau of Standards has prepared a helpful and informative booklet, "Moisture Condensation in Building Walls." Use the coupon and we will send a free copy.

THERMAL VALUES
Infra Type 4 Parallel Insulation

Up-Heat	C .105 = 3⅛" non-metallic insulation*
Wall-Heat	C .068 = 4¾" non-metallic insulation*
Down-Heat	C .042 = 7⅞" non-metallic insulation*

*Based on limiting values cited in Fed. Specs. LLL-f-321b; HH-I-585; HH-I-521c; HH-I-551a.

Cost installed between wood joists, material and labor, about 8¢ sq. ft.

Type 6 also available

Can be purchased everywhere through your preferred local dealer.

Infra Insulation, Inc., 525 Bway., N. Y. C. Dept. H-3
Send "Moisture Condensation in Building Walls."

Name__________

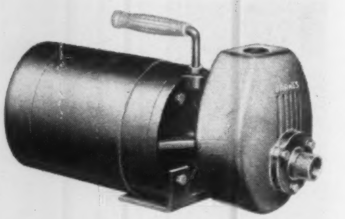
Firm__________

Address__________

EQUIPMENT DEVELOPMENTS

Continued

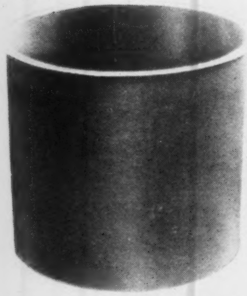
to seal any liquids that will not attack "Buna-N" flexible parts or brass metal parts, says company. Face is manufactured from filled true carbon. Roll designed bellows is said to allow greater travel. For pressures to 100 psi. Available for $\frac{5}{8}$, $\frac{3}{4}$ in. diameter shafts with general operating limitation of 212 F with shaft speeds to 1000 fpm.



Close Coupled Pump . . .

. . . added to company's line of "self priming" centrifugal pumps—*Barnes Mfg. Co., Dept. HPAC, Mansfield, Ohio.*

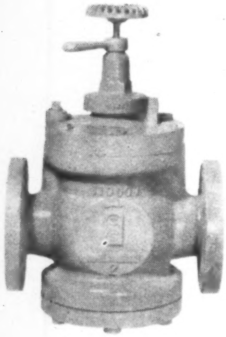
"Model 1MAE" is direct connected to 1/3 hp motor—115 volt, 60 cycle, split phase—delivering 3450 rpm. Unit designed to discharge 1440 gph at 24 ft head. Recommended by company for use in industrial plants, light construction jobs.



Polyester Glass Tanks . . .

. . . designed to resist effects of brine, other corrosive solutions—*Haveg Industries, Inc., Dept. HPAC, 900 Greenbank Rd., Wilmington 8, Del.*

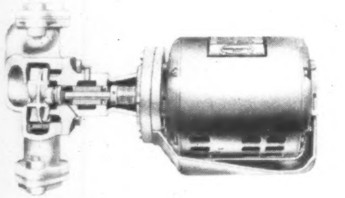
Available in light duty, heavy duty types. Are said to be light in weight, easy to install. Company fabricates to specific requirements.



Valve . . .

. . . for steam service, featuring built-in pilot and main valve strainers—*A.W. Cash Co., Dept. HPAC, P.O. Box 551, Decatur, Ill.*

Pressure reducing, regulating unit is single seat, internal pilot operated, piston actuated model. Is said to be highly sensitive, responsive to small changes in reduced pressure. Maximum inlet pressure is 250 psi at 400 F, delivery pressures range 5 to 250 psi. Sizes are 2, $2\frac{1}{2}$, 3, 4 in. with iron body, flanged ends.



Hot Water Circulator . . .

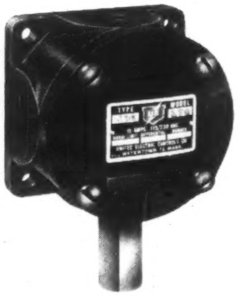
. . . designed to give full lift with quiet, "vibration-free" operation—*Metalmaster Corp., Dept. HPAC, 66 Elm St., Newark, N.J.*

Cited features: rubber mounted, self aligning, overload protected motor; balanced impeller; hardened shaft; "watertight" carbon and stainless steel seals; absorbent bearings. "Model 100" has full capacity for $1\frac{1}{2}$ in., but interchangeable flanges can be supplied for $\frac{3}{4}$, 1, $1\frac{1}{4}$ in. application, says company.

Room Air Conditioners . . .

. . . in new 1957 "Tru-Slim" series—*Emerson-Quiet Kool Corp., Dept. HPAC, 46 Oliver St., Newark 5, N.J.*

With modern slim, low design which permits flush mounting and does not obstruct windows, says company. Cited features: pushbutton controls, automatic thermostat, "aero-directional" wheels, one-piece air tunnel construction, permanent filter, decorator styling, electrically operated dampers, double blower fan system with two fan motors on 1 hp models. Other series in manufacturer's line include models rated $\frac{3}{4}$ to 2 hp.



Pressure-Vacuum Control

. . . with explosionproof design—*United Electric Controls Co., Dept. HPAC, 79 School St., Watertown, Mass.*

"Type J95" designed for use in locations where explosive vapors or gases are present. An uncalibrated unit, pressure settings are made by means of internal adjusting nut. Models available with adjustable ranges between zero and 500 psi, maximum pressures to 600 psi. On-off differentials between 2 and 30 psi obtainable. Basic components include pressure assembly and snap-acting switch operated by pressure assembly. Supplied with any one of three standard types of switches.

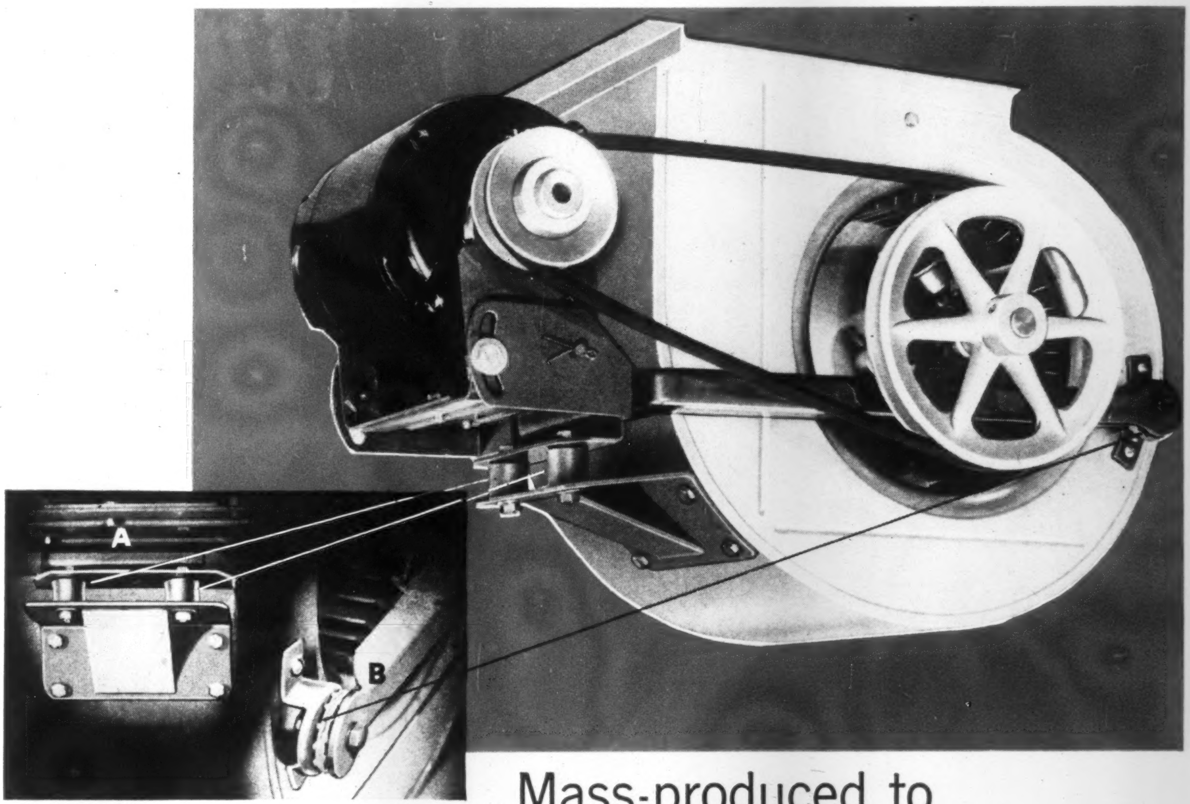
Gray Tinted Glasses . . .

. . . designed to absorb heat, reduce glare—*Pittsburgh Plate Glass Co., Dept. HPAC, 632 Ft. Duquesne Blvd., Pittsburgh 22.*

In two types, one is heat-absorbing plate glass called "Solargray," while other is heavy sheet glass named "Pennvernon," formulated to provide brightness or glare control.

(*Continued on page 206*)

ENGINEERED RUBBER PRODUCTS



Mass-produced to exacting specifications

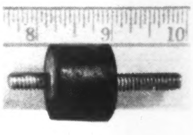
U. S. Rubber Molded Mountings and Connectors help keep blowers operating at "whisper silence".

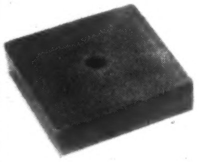
A well-adjusted system for a forced warm air furnace requires that all vibration and noise be kept to an absolute minimum. In this leading "sulky" type blower, the entire moving parts assembly floats on a cushion of U. S. Molded Rubber Mounts (A) and firm, but movement-free, U. S. Rubber Finger-Flex Connectors (B). In this manner, all mechanical vibrations are isolated—the blower operates in silence.

U. S. Rubber Molded Mountings and Connectors were selected because of their ability to retain "molded in" shape during their entire long life and for the economy they provide.

Yet, this is only one of hundreds of applications wherein U. S. Engineered Rubber Products *do jobs no other material can do.* "U. S." engineers will help you solve any molded rubber problem. Contact us at Rockefeller Center, New York 20, N. Y. In Canada, Dominion Rubber Co., Ltd.

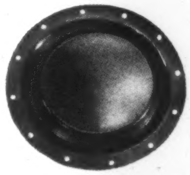
U. S. Molded Shock Mounting for shock absorption when shipping delicate instruments. An electric typewriter manufacturer, for instance, has cut down shipping damage to ½% and cut packaging costs considerably. Improved rubber-to-metal bonding permits their re-use.





U. S. Molded Drop Forge Mounting in service for over 13 years—absorbed *80 million* blows of almost 1600 lbs. force each without wearing out—removed only when steel retaining pins had corroded.

U. S. Molded Diaphragm for controlling liquid flow through motor valves. Offers high burst resistance, retention of molded shape under high pressures, and exact fabric placement.



Mechanical Goods Division

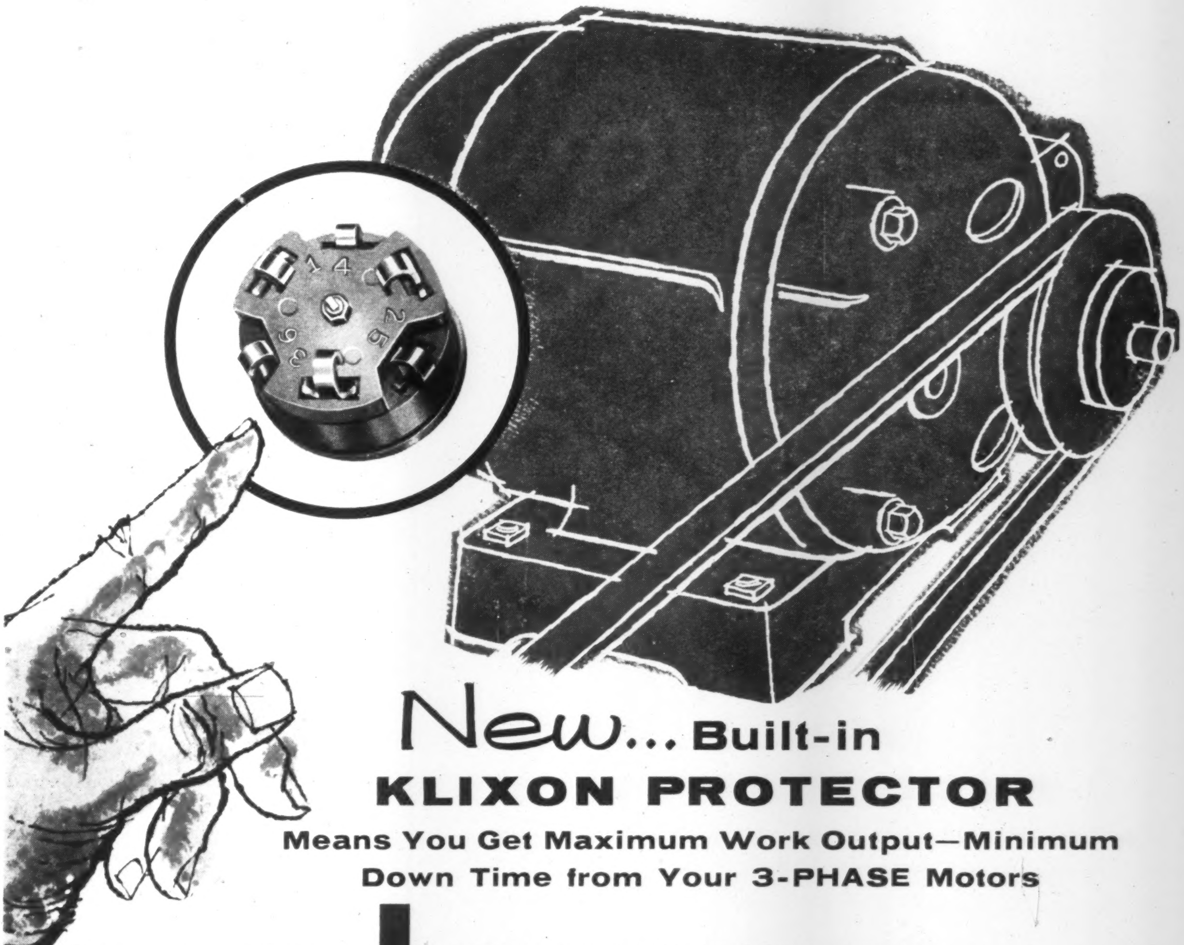
United States Rubber

Strike it ri
WHEATLAND - 57

Rich, indeed, are the dividends of satisfaction and performance you will obtain by specifying Wheatland Steel Pipe for every industrial purpose. In black or galvanized, Wheatland's matchless quality and unique year mark on every length are your guarantee of long, trouble free service.

WHEATLAND TUBE COMPANY

BANKERS SECURITIES BLDG., PHILA. 7, PA. MILLS • WHEATLAND, PA. • DELAIR, N. J.



New... Built-in KLIXON PROTECTOR

Means You Get Maximum Work Output—Minimum Down Time from Your 3-PHASE Motors

Specify
and use motors with Built-in
KLIXON PROTECTORS

BUILT-IN KLIXON AUTOMATIC PROTECTORS AND MANUAL RESET FOR 3-PHASE MOTORS

- Reduce Production Down Time
- Eliminate Motor Burnouts
- Minimize Motor Repairs and Replacements
- Assure Maximum Motor Capacity Under Any Conditions
- Simplify Motor Controls

PREVENT OVERHEATING CAUSED BY:

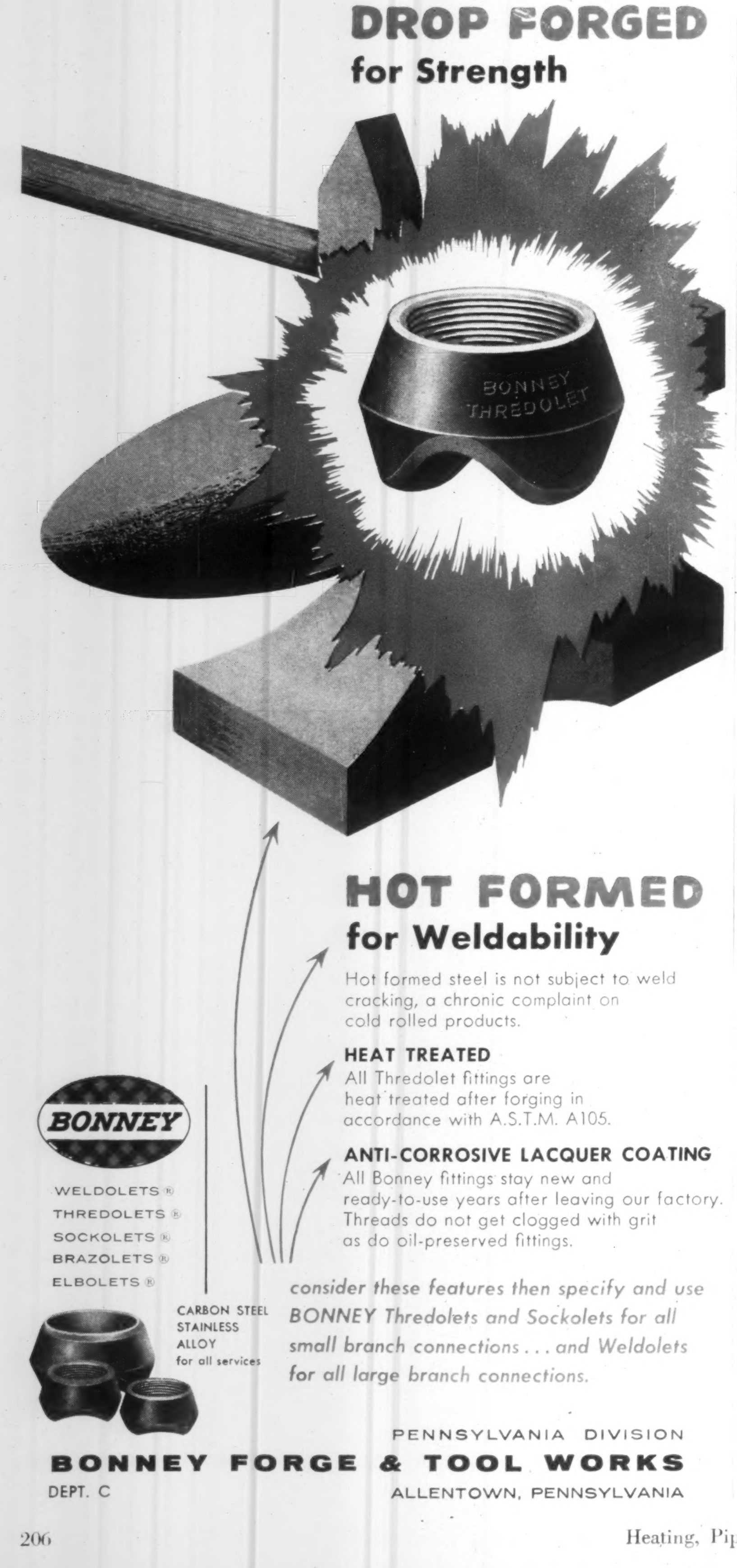
- **Prolonged overloads**
- **Single phasing**
- **Stalling**
- **Failure to start**
- **Lack of ventilation**
- **Increase in ambient temperature**
- **Plugging or reversing duty**
- **Unbalanced voltage**

Now you can count on the same maximum output under adverse conditions from your 3-phase motors as you've had for years from your Klixon-protected single phase motors. That's because motor manufacturers everywhere can supply standard 3-phase motors with Built-In Klixon Protectors.

You can get this protection built into your 3-phase motors from fractionals up through 7½ HP (600V) sizes.

Get the details from your district motor salesman, then specify and use motors with Klixon Inherent Protectors. The additional cost is low . . . the savings high . . . the advantages really worth while.

METALS & CONTROLS CORPORATION
Spencer Thermostat Division 3403 Forest Street, Attleboro, Mass.
KLIXON ®


DROP FORGED
for Strength

HOT FORMED
for Weldability

Hot formed steel is not subject to weld cracking, a chronic complaint on cold rolled products.

HEAT TREATED
All Thredolet fittings are heat treated after forging in accordance with A.S.T.M. A105.

ANTI-CORROSIVE LACQUER COATING
All Bonney fittings stay new and ready-to-use years after leaving our factory. Threads do not get clogged with grit as do oil-preserved fittings.

BONNEY
WELDOLETS ®
THREDOLETS ®
SOCKOLETS ®
BRAZOLETS ®
ELBOLETS ®

CARBON STEEL
STAINLESS
ALLOY
for all services

consider these features then specify and use BONNEY Thredolets and Sockolets for all small branch connections . . . and Weldolets for all large branch connections.

PENNSYLVANIA DIVISION
BONNEY FORGE & TOOL WORKS
DEPT. C
ALLENTOWN, PENNSYLVANIA

EQUIPMENT DEVELOPMENTS

Continued from page 202

V. D. ANDERSON

Air Release Valves . . .
. . . for heating, piping and air conditioning contractors, engineers, maintenance men *V.D. Anderson Co., Dept. HPAC, 1935 W. 96th St., Cleveland 2.*

Are said to be automatic and continuous in operation, release air as fast as it accumulates. Normally installed at high points of piping system where air pockets naturally form. Cited applications include: industrial and municipal pipelines; for venting air from hot water heating systems; chilled water air conditioning systems. In three types for maximum pressures 125 and 250 psi.

Sump Pump . . .
. . . designed to lift 222 gpm of water, oil, sewage or moderately heavy sludge to 30 ft head—*Atlas Copco Eastern, Inc., Dept. HPAC,* 151 *Linwood Ave., Paterson, N.J.*

Operates on pressure of 85 psi. Weighs about 50 lb. Will start under full load when wholly submerged, says company.

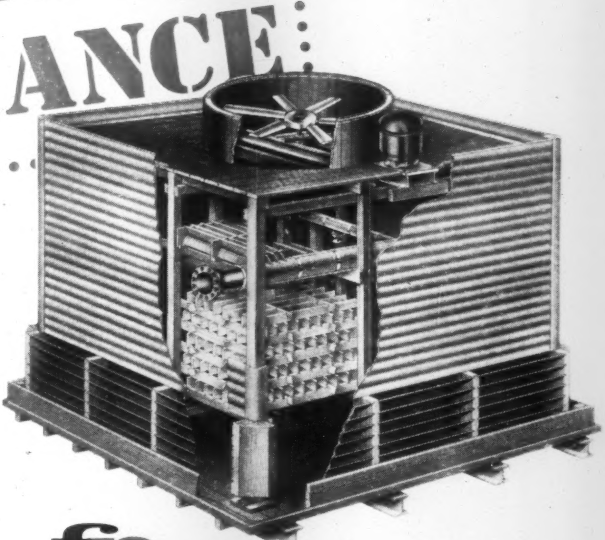
FLUOR
CERTIFIED PERFORMANCE

FOR YOUR PROTECTION all performance rating data used to design Fluor Series 3 Counterflow Cooling Towers bears the stamp "Certified Performance."

To you who specify cooling towers for air conditioning and refrigeration service this means:

1. That the cooling tower offered has undergone rigorous tests for efficiency through complete ranges of actual heat transfer conditions.
2. That the rating data developed is realistic — established under tests duplicating those of virtually every operating condition.
3. That the data thus developed — and used by Fluor — has been authenticated when compared with test data furnished by an impartial, independent research organization.*

The following tables compare the performance rating data used by Fluor in designing your tower, with the test findings of an independent organization.



SERIES THREE

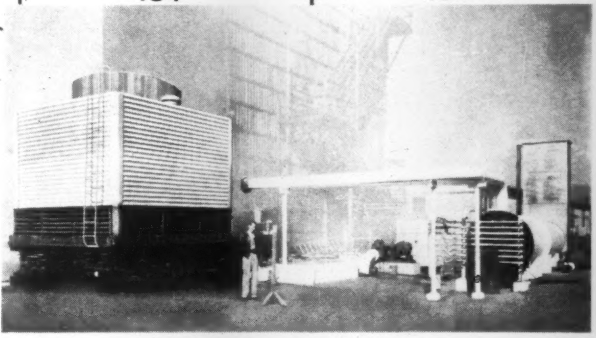
DESIGN CONDITIONS			FLUOR RATED PERFORMANCE	INDEPENDENT TEST DATA*
WET BULB TEMP.	WATER OFF TEMP.	WATER ON TEMP.	TONS REFRIGERATION	TONS REFRIGERATION
70	80	90	174	184
70	77.5	85	121	128
75	85	95	196	214
78	85	95	160	163
78	86	96	178	185
78	85	92.5	140	155
78	87.5	95	181	218
78	86	93.5	159	163
80	86	93.5	134	139

* INDEPENDENT PERFORMANCE TEST RESULTS obtained for Fluor Products Company by Texas Engineering Experiment Station on December 6 and 7, 1956 at Fluor's Cooling Tower Research and Test Center in Los Angeles, California.

The Texas Engineering Experiment Station is a part of Texas A & M College System. The station provides research facilities for the college and conducts independent tests for governmental agencies and industrial organizations.

Texas Engineering Experiment Station provides test data only and does not endorse this or any product.

Illustration at right shows a Fluor Series 3 Cooling Tower being performance tested under actual heat transfer conditions.



AIR CONDITIONING & REFRIGERATION COOLING TOWER DIVISION

FLUOR PRODUCTS COMPANY

A DIVISION OF THE FLUOR CORPORATION, LTD.

GENERAL OFFICES • WHITTIER, CALIFORNIA

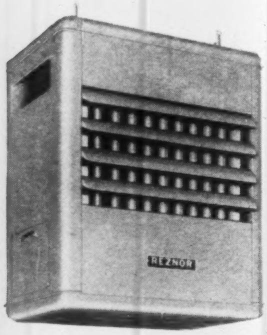
Representatives In All Major Market Areas . . .

"We like Reznor gas unit heaters because initial costs are low; our clients prefer them because they're so inexpensive to maintain and operate"

"We're convinced that Reznor gas unit heating is the best heating investment for a wide variety of commercial and industrial buildings. Under the right conditions, no other system can approach it for performance. Under any conditions no other system can approach it for economy.

"We found that the cost of the necessary Reznor gas unit heaters compares very favorably with the cost of any other type of heating equipment of the same total capacity. And with Reznor, the equipment cost is total cost. There are no registers or radiators, no expensive piping or duct work to buy. That means real savings on installation cost, too. To install a Reznor gas unit heater you just suspend it, make simple gas, electrical and vent connections and move on to the next one. That's real economy . . . it helps stretch budgets.

"Our clients like Reznor heaters for other reasons, too. Reznor heaters not only save money in the beginning, they keep on saving year after year. Reznor heat is instant heat . . . there's no need for costly stand-by firing. With on-the-spot Reznor heat, there's no heat lost in transmission. And with each Reznor heater operating independently, there's no need to heat areas which aren't in use. All this adds up to substantial savings on fuel. Reznor heaters require no operating labor. And maintenance costs are practically zero. All Reznor heaters require a simple cleaning once a year. It's no wonder that our clients who have tried it once want Reznor heating in their next building."



Remember, there is no equivalent for Reznor gas unit heaters. Be sure you have complete information on these fine heaters at your fingertips. Write today for your free catalog or call your nearby Reznor distributor. You'll find him listed under "Heaters-Unit" in the yellow pages of your telephone directory.

REZNOR
THE WORLD'S LARGEST-SELLING
GAS UNIT HEATERS
REZNOR MANUFACTURING COMPANY
51 Union Street, Mercer, Pa.

EQUIPMENT DEVELOPMENTS

Continued

No. 78
WATER
VENT
VALVE

Water Vent . . .

. . . especially designed for high pressure returns of water systems and for high pressure process applications — systems having to 346.5 ft static head pressure—*Hoffman Specialty Mfg. Corp., Dept. HPAC, 1700 W. 10th St., Indianapolis.*

"No. 78" will stand hydrostatic pressures of 150 psi, says company. Cited features include cast brass body, steel copper-clad float, $\frac{1}{4}$ in. drain tube fitting and ferrule for vented moist air. Connections are $\frac{1}{2}$ in. female, $\frac{3}{4}$ in. male.

Hot Water Storage . . .

. . . system designed to solve problems in installing or maintaining hot water supply in commercial applications—*Ruud Mfg. Co., Dept. HPAC, Kalamazoo, Mich.*

"A-138" system consists of 115 gal aluminum alloy tank mounted on $2\frac{1}{2}$ in. high base and enclosed with heavy insulation within steel jacket. Shown above is unit secured as package with company's "AS 20-80 Sanimaster" gas water heater.

ideal . . . for commercial air conditioning, industrial liquid cooling

Bulletin No. 560
Product Classification FP
February, 1957

COMPACT
neat, attractive unit takes less space than most automatic washers.

NON-FERROUS WATER CIRCUIT
no rust or corrosion.

QUIET
as quiet as a household refrigerator.

SIMPLE DESIGN
easy to operate, requires minimum maintenance.

LOCATE ANYWHERE
remote, indoors, outdoors, in basement, garage, breezeway, etc.

PROVEN PRINCIPLES APPLIED
as used in air conditioning hospitals and large commercial buildings.

ZONED COOLING
each room's temperature individually controlled, exactly, as you want it.

INEXPENSIVE TO INSTALL
units complete with refrigerant charge and factory-wired operating and protective controls.

COMPLETE HERMETIC REFRIGERATION SYSTEM factory assembled, charged and tested.

AIR COOLED

WATER COOLED

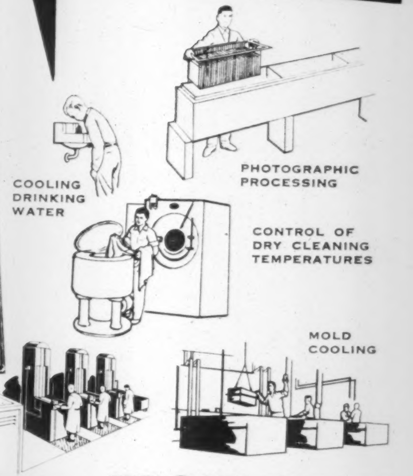
CONTROLLED WATER CIRCULATION
nature's most efficient means of heat transfer.

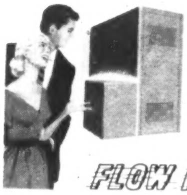
Acme
FLOW PAC®
PACKAGED
WATER
CHILLERS
1¾ thru 5 hp.

perfect for wet system . . . residential air conditioning

AIR CONDITIONING

Here's the ANSWER to SMALL TONNAGE LIQUID CHILLER REQUIREMENTS





GET THIS NEW CATALOG on Acme FLOW-PAC®

PACKAGED CHILLERS

FLOW PAC features

Takes less space than most automatic washers — Hermetic refrigeration circuit, non-ferrous water circuit — Inexpensive to install . . . shipped complete with refrigerant charge and factory-wired operating and protective controls — 1¾ thru 5 hp, air-cooled and water-cooled models.

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for your copy of the new Flow-Pac catalog

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☐ Please send me your new Flow-Pac literature.
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ACME
AIR CONDITIONING
REFRIGERATION

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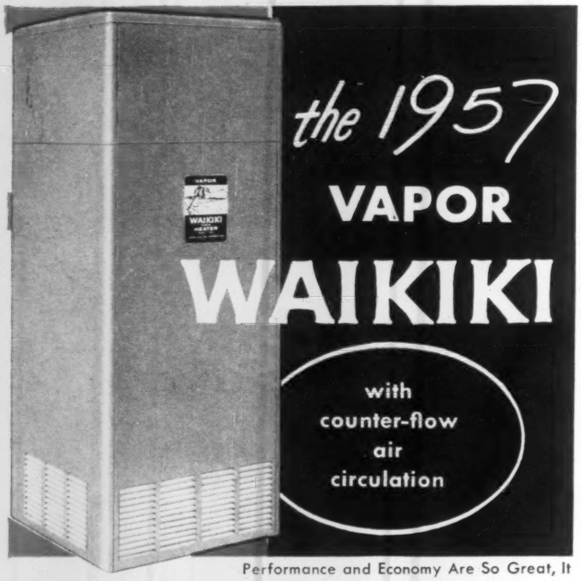
Dry-Ex Liquid Chillers · Liquid Receivers · Heat Exchangers · Condensers · Packaged Chillers · Packaged Heat Pumps · Evaporative Condensers & Cooling Towers · Room Conditioners

Manufacturers of Quality Air Conditioning and Refrigeration Equipment since 1919

INTRODUCING
A REVOLUTIONARY NEW
HIGH-VOLUME SPACE HEATER



Performance and Economy Are So Great, It

ACTUALLY "ANTIQUATES" MOST OTHER SPACE HEATERS

A whopping 2800 cubic feet of heated air capacity per minute—positive circulation. As an example of the high output capacity, a single Waikiki would deliver enough heated air to keep three 5-room houses comfortable! . . . and multiple units multiply output—provide "spot" or overall heat distribution with important savings. Here's dependable high-volume heat output built and backed by 50 successful years of Vapor Heating Corporation heating equipment specialization.

Delivers 200,000 btu/hr—Automatically.

FOR . . . physical comfort, for curing concrete, drying paint and plaster, thawing frozen pipes, defrosting ice machines and cold rooms. For pre-heating materials to speed processing, melting ice accumulations within refrigerated trucks and trailers—and a host of other applications!

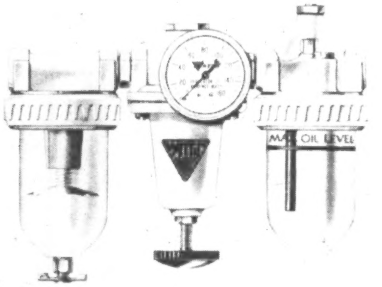
Burns Kerosene, Fuel Oils Nos. 1 and 2, Gas (Natural, Manufactured, L.P.)

Send for complete story of this completely NEW Space Heater

VAPOR HEATING CORPORATION
80 East Jackson Boulevard, Chicago 4, Illinois, Dept. 21-C

Please send me Waikiki Bulletin No. 445.

Name________ Title________
Company________
Address________
City________ State________



Filter-Regulator-Lubricator . . .

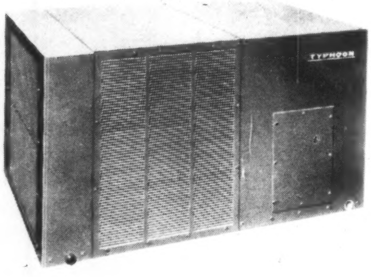
. . . combination unit designed to provide high efficiency regulation, lubrication of compressed air supply to pneumatically operated equipment—*Watts Regulator Co., Dept. HPAC, Lawrence, Mass.*

In $1/4$, $3/8$, $1/2$ in. sizes. Cited feature of filter is "tornado action," which is design of contoured air passage said to impart powerful downward spiral motion to incoming air. Regulator has "aspirator" designed to provide fast compensation or regulation of reduced pressure under conditions of changing flow demands. Lubricator engineered with "high velocity" venturi section.

Remote Integrating Counter . . .

. . . for use with pneumatic transmission systems—*Bristol Co., Dept. HPAC, Waterbury, Conn.*

Seven-digit counter receives signal from measuring transmitter which operates on impulse duration system. Since electric signal transmitted is a function of time, line voltage variations do not effect accuracy of counter, says company.



Waterless Air Conditioner . . .

. . . for installation in small stores, offices—*Typhoon Air Conditioning Co., Div. of Hupp Corp., Dept. HPAC,* 505 *Carroll St., Brooklyn* 15.

Can be used with or without ductwork, located in basement, crawl space, through-the-wall, or in window or transom, says company. Operates on single phase, 60 cycle current at 230 volts. Uses fluorinated hydrocarbon refrigerant No. 22. In two models with 24,000 and 36,000 Btu capacities.

LEADING AGAIN IN '57!

. . . look over this broad line and see why

Waterloo
AIR DIFFUSION EQUIPMENT

"Since 1902"

is your best source for all air diffusion equipment

FOR USE IN

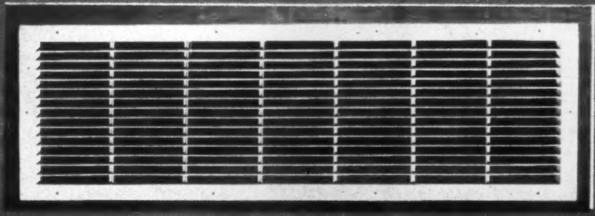
- Schools
- Churches
- Hospitals
- Hotels
- Apartments
- Retail Stores
- Medical Centers
- Office Buildings
- Theaters
- Restaurants
- Government Buildings
- Industrial Buildings

The Waterloo Register Company has been a leader in the development of air diffusion equipment, particularly in the commercial field, since the inception of air conditioning and ventilation. Since 1902 it has proven its outstanding performance features, intrinsic modern styling and quality construction. Waterloo's exclusive adjustable "tear drop" louvre design assures efficient operation, preventing excessive turbulence, noise or loss of energy. We are grateful to the many leading architects, engineers and contractors who, by specifying WATERLOO for their finest structures, have placed it among America's favorites.

Special Facilities for Unusual Service

When you're on the spot, WATERLOO'S exceptional delivery service permits meeting exacting production schedules. During the past year our production facilities have been still further expanded — new items have been added — to further increase our ability for unusual services on quality equipment.

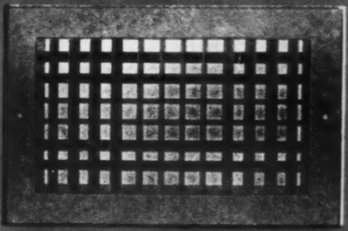
HEAVY DUTY RETURN AIR GRILLE



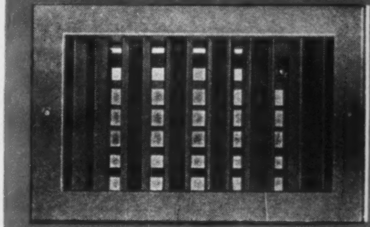
Write for New Waterloo Air Diffusion Equipment Folder.

WATERLOO REGISTER CO., Inc.

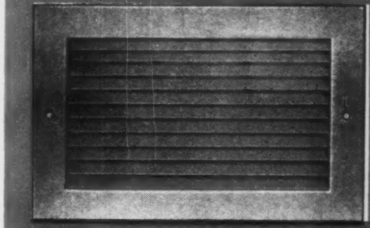
P. O. BOX 72
WATERLOO, IOWA, U. S. A.



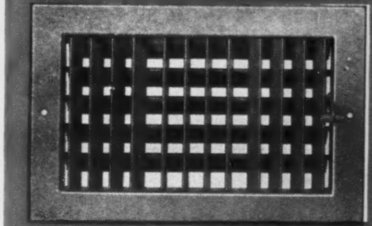
2V SUPPLY GRILLE



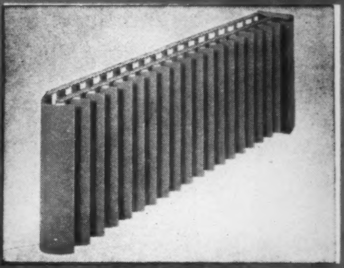
2VO SUPPLY REGISTER



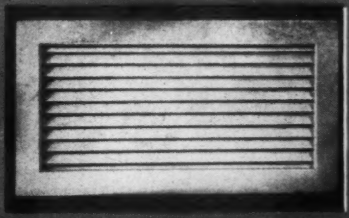
3H RETURN AIR GRILLE



IVMH SUPPLY REGISTER



DUCTROL AIR VOLUME EXTRACTOR



DV DOOR GRILLE

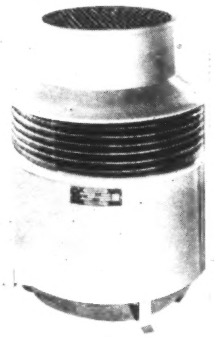
MODERN BUSINESS

AND MODERN SCHOOLS

NEED EACH OTHER
MORE THAN EVER!

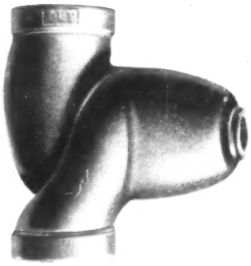
This has been a great year! America is building and replacing and thus moving faster than ever before. Only one thing. Will the labor market keep pace? That's where schools are important. If your company isn't helping community groups to get modern schools, it's not apt to get the skilled people it needs. Self interest, civic spirit, or both, you should make schools your business, too.

Want to find out how to help in *your* community?
Get specific information by writing:
Better Schools, 9 East 40th Street, New York, N. Y.



Air Conditioner . . .
. . . with air cooled operation—*F-5 Air Conditioning Corp., Dept. HPAC, 1815 S. Maybelle, Tulsa.*

"Fandaire" recommended by company for areas where water for air conditioning is restricted or prohibited. Uses sloped circular condensing coil designed to eliminate blind spots, permit efficient drainage of condensing refrigerant. Available in 3, 5, 7½, 10 ton models.

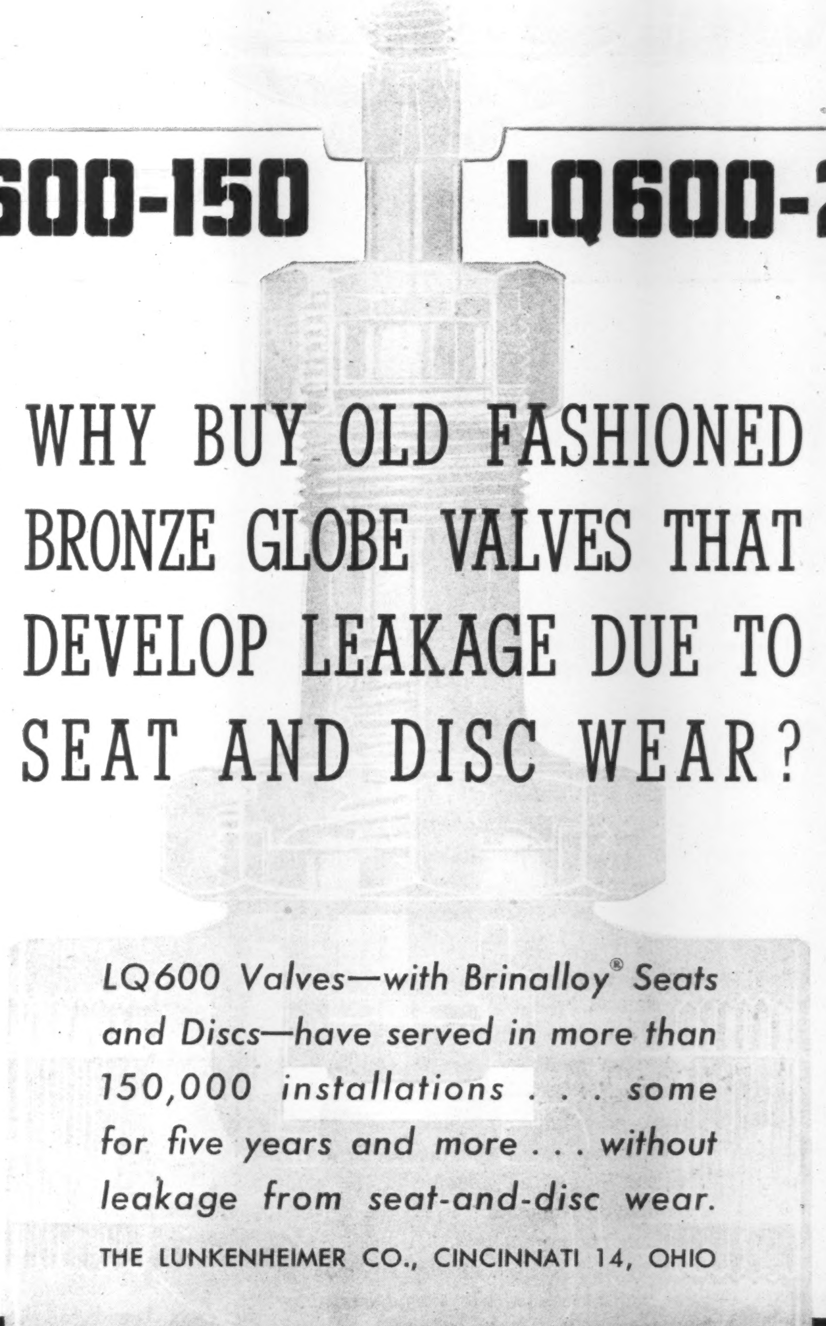


Separator Fitting . . .
. . . designed to separate air from water systems for venting through company's "No. 75" or "78" vent valve—*Hoffman Specialty Mfg. Corp., Dept. HPAC, 1700 W. 10th St., Indianapolis.*

Is said to assure good performance from water system, reduce noise caused by air. Of cast iron construction. Available in 1¼, 1½ in. pipe sizes.

Room Air Conditioner . . .
. . . with low, narrow design—*Remington Air Conditioning Div., Remington Corp., Dept. HPAC, Auburn, N.Y.*

"Lo-Narro" units to be available in



LQ600-150 **LQ600-200**

WHY BUY OLD FASHIONED BRONZE GLOBE VALVES THAT DEVELOP LEAKAGE DUE TO SEAT AND DISC WEAR?

LQ600 Valves—with Brinalloy® Seats and Discs—have served in more than 150,000 installations . . . some for five years and more . . . without leakage from seat-and-disc wear.

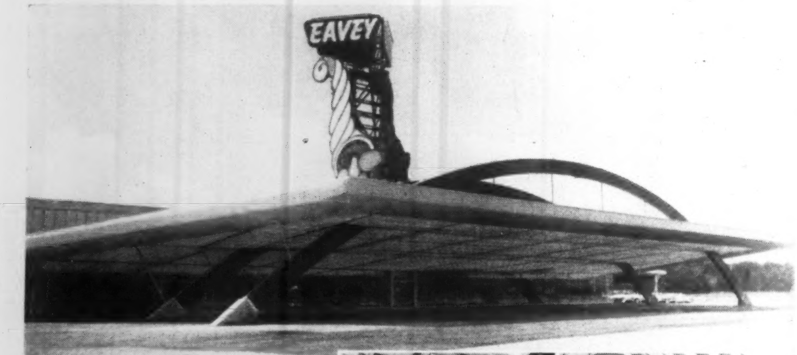
THE LUNKENHEIMER CO., CINCINNATI 14, OHIO

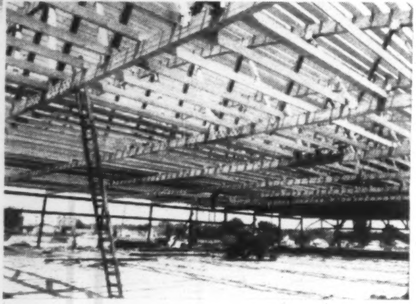
L-756-14

LUNKENHEIMER®

THE ONE *Great* NAME IN VALVES

Supermarket spans years of construction progress . . . USES *Ramset*®!





Ramset System
saves $10,000 and
two months' time
for new Ft. Wayne
Supermarket

Using the latest construction methods, contractors completed Eavey's Supermarket in Fort Wayne, Indiana, ahead of schedule and ahead of budget!

One contractor reported hanging 10,000 feet of conduit pipe with RAMSET, using 100,000 fasteners for the job. About $10,000 and two full months were saved by using speedy RAMSET SYSTEM, according to George Clement, service engineer for Eavey's. Other contractors saved in the same way.

RAMSET FASTENING SYSTEM can be used in a variety of ways on most jobs: electrical, plumbing, air conditioning, door, window and wall installations. Moreover, RAMSET is just as valuable in the plant maintenance operation as to the original builders and contractors.

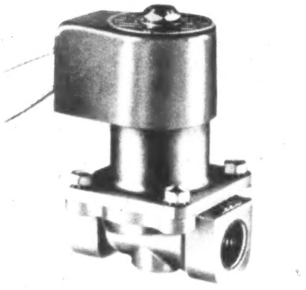
You can anchor almost anything to concrete and steel with RAMSET. New catalog is ready, send for your copy now.

companion tool
Shure-Set
TRADEMARK
Baby brother to RAMSET, this hammer-in tool uses no cartridge, but makes your own hammer power more effective. For masonry, mortar joints, cinder block. Ask for literature.

Ramset Fastening System
WINCHESTER-WESTERN DIVISION
OLIN MATHIESON CHEMICAL CORPORATION

12109-C BEREA ROAD • CLEVELAND 11, OHIO

$\frac{3}{4}$, 1 hp sizes. Dimensions are said to be adaptable to most window styles. One hp unit may be connected to standard 15 ampere, 115 volt circuit, says company.



Solenoid Valve . . .

. . .for automatic flow control of steam, hot fluids or gases to 400 F —*Automatic Switch Co., Dept. HPAC, 391 Lakeside Ave., Orange, N.J.*

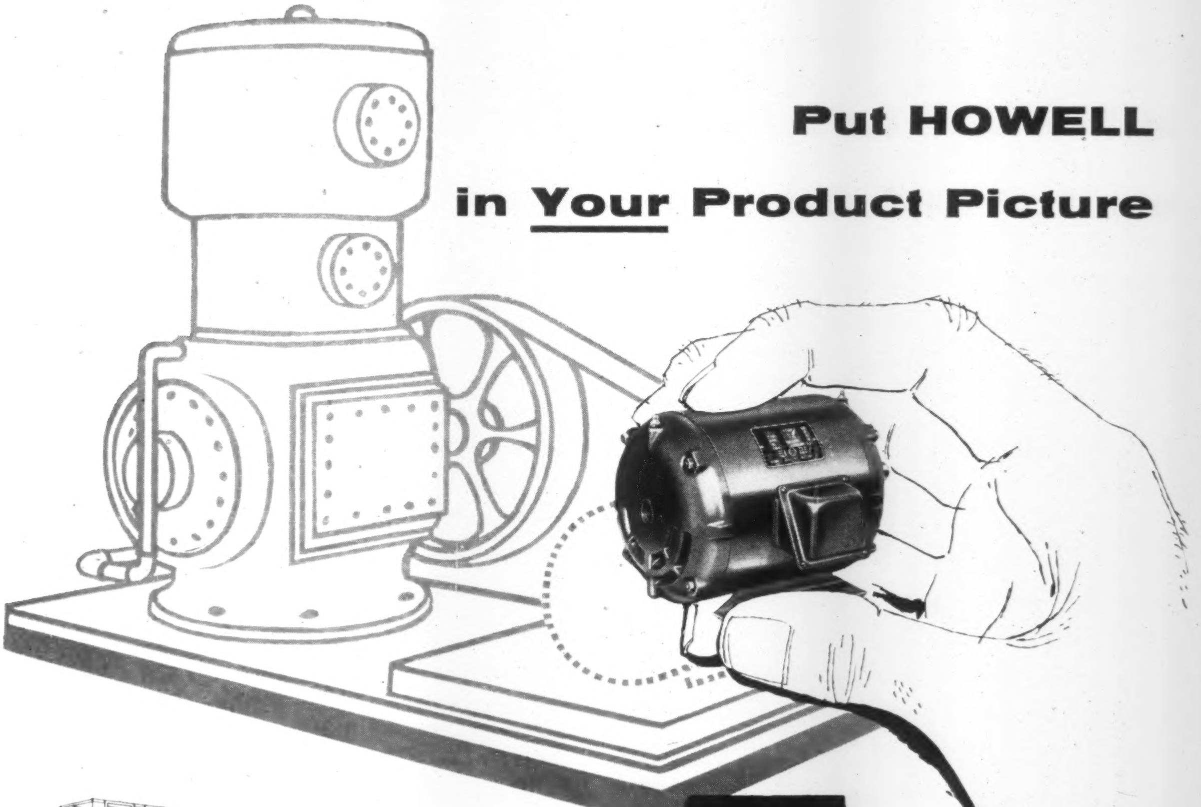
Packless, two-way, internally pilot operated units recommended by company for use in heat exchangers, industrial cleaning machines, commercial dish washers, sterilizing machines and systems, dry cleaning machines. Available in $\frac{3}{8}$ and $\frac{1}{2}$ in. IPS.

Chemical Pump Packing . .

. . .for emergency use against industrial acids, alkalies, solvents—*Abbott & Biddle, Dept. HPAC, 2413-27 Federal St., Philadelphia 46.*

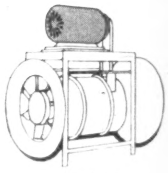
"403" is composed of shredded "Teflon" combined with suitable binders, lubricants extruded in open cotton yarn jacket impregnated with graphite. Also available in bulk form "403S" for use for packing multisize fittings, applications where need for

Put HOWELL in Your Product Picture

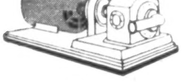


...and gain the **PLUS values in power** that count!

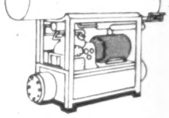
COOLING TOWERS



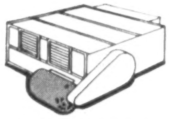
BLOWERS



PUMPS



PACKAGED CHILLERS



CENTRAL SYSTEM CONDITIONERS

Your most efficient air conditioning equipment depends . . . year in and year out . . . on the motor you select to power it. That's why so many manufacturers in the air conditioning industry fill their specifications for integrals, 1 thru 300 hp, with Howell Motors. *Note these features:*

EXTRA DEPENDABILITY that challenges the years. Howell's new principle of heat-source ventilation . . . double sealed bearings . . . tough rolled steel frames and precision fitted cast iron end plates . . . these and many more are plus values that ***count!***

AN UNSURPASSED REPUTATION for engineering excellence and quality manufacture . . . built up by Howell in over 40 years of serving industry's motor requirements.

TOPS IN APPEARANCE. No other industrial motors have such smooth, unbroken contours . . . without an external fin or rib to mar their looks or catch dust deposits.

Howell makes virtually every type of AC industrial motor . . . fractional and integral to 300 hp, in all standard enclosures, in rerated and non-rerated frame sizes, and in many pump mountings. Howell part winding motors, for reduced voltage starting of compressors, pumps, etc., may be of special interest to you.

These motors are specified and used by these leading manufacturers of air conditioning equipment:

York Corp. ● Acme Industries ● Worthington Corp. ● Frick Corp. ● The Trane Co. ● Binks Manufacturing Co. ● American Blower Corp.

A Howell sales engineer can give you valuable assistance on any motor application. Wire or 'phone collect . . . or drop us a line . . . you'll get prompt action. Howell Electric Motors Co., Howell, Michigan.

HOWELL *motors*

. . . precision built for industry since 1915

SNAP*ON..new way to insulate high velocity ducts in a hurry

Snap*On, originally designed as a one-piece pipe insulation molded of fine glass fibers, is also a "natural" for high velocity ducts. With Snap*On, you can insulate 6 ft. of duct in one easy spread-and-snap motion.

Wall thickness and heat savings are uniform because this unique insulation is molded to *uniform* thickness and won't lose thickness during application. Thermally, you get the most efficient duct insulating material on the market today. In exposed areas where appearance is important, the uniform thickness of Snap*On insures a smooth even surface for canvas or vapor barrier finishes.

For heating ducts, Snap*On comes in 3 ft. sections with canvas jacket or in 6 ft. sections, plain. For dual temperature or cooling ducts, Snap*On comes in 3 ft. sections with factory applied vapor barrier jacket. Both are available in sizes up to 33 in. I. D.

For complete information and prompt delivery, call your local Snap*On distributor listed in adjoining column.

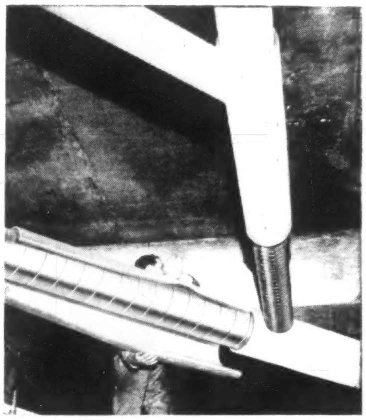
*Trademark Reg.

GUSTIN-BACON Mfg. Co. GUSTIN gb BACON

Thermal and acoustical glass fiber insulations • Pipe couplings and fittings
Molded glass fiber pipe insulation

220 W. 10th ST., KANSAS CITY, MO.

See Adjoining Column for Local Snap*On Distributor



G-B SNAP-ON DISTRIBUTORS

(See ad on facing page)

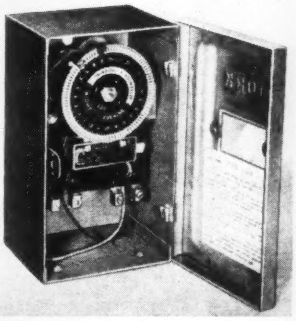
ALBUQUERQUE, Mt. States Insulation Co.
AMARILLO, Ball Distributing & Engr. Co.
APPLETON, J. D. Wilson Co.
ATLANTA, Ga., Southern States Iron Roofing Co.
BILLINGS, Mont., Big Horn Supply, Inc.
BIRMINGHAM, Ala., Shook & Fletcher Supply
Southern States Iron Roofing Co.
BROOKLINE, Mass., Homans-Kohler, Inc.
BUFFALO, Frontier Insulation & Supply Co.
CHARLESTON, W. Va., Baldwin Asbestos Products Co.
CHARLESTON HEIGHTS, S. C., Stafford Insulation Co.
CHARLOTTE, N. C., Guy M. Beaty & Co.
CHATTANOOGA, Guy M. Beaty & Co.
CHICAGO, E. C. Carlson Co.
CINCINNATI, R. E. Kramig & Co.
CLEVELAND, The Miles Materials Co.
COLUMBUS, Santeler Brothers
DALLAS, Insulation Supply Co., Inc.
DAVENPORT, Republic Electric Co.
DENVER, Gene Wright Lumber Co.
DETROIT, Coon-DeVisser Co.
EL PASO, Insulation & Specialties Co.
FARGO, N. D., Smith, Inc.
FT. SMITH, Ark., Gunn Distributing Co.
FT. WAYNE, Ind., M. H. Hilt, Inc.
FT. WORTH, The Bracken Co.
GREENSBORO, N. C., Starr Davis Co., Inc.
GULFPORT, Miss., Paine Supply Co.
HOUSTON, Precision Insulation Co.
INDIANAPOLIS, Central Supply Co.
IRON MOUNTAIN, Mich., Champion, Inc.
JACKSON, Miss., Paine Refrigeration Supply Co.
JOPLIN, Mo., Joplin Cement Co.
KANSAS CITY, Kelley Asbestos Co.
LITTLE ROCK, Gunn Distributing Co.
LOS ANGELES, Western Fibrous Glass Products
Thorpe Insulation Co.
LOUISVILLE, General Insulation & Roofing Co.
MADISON, Wis., J. D. Wilson Co.
MEMPHIS, John A. Denie's Sons Co.
MIAMI, Southern States Iron Roofing Co.
MILWAUKEE, J. D. Wilson Co.
MINNEAPOLIS, Asbestos Products, Inc.
MOBILE, Ala., Shook & Fletcher
NASHVILLE, Southern States Iron Roofing Co.
NEWARK, N. J., Eastern Steam Specialty Co.
NEW HAVEN, Conn., Insulation Supply Co.
NEW ORLEANS, Eagle Asbestos & Packing
NEW YORK, Eastern Steam Specialty Co.
OKLAHOMA CITY, Ball Distributing & Engineering Co.
OMAHA, Cardinal Supply & Mfg. Co.
PHILADELPHIA, John F. Scanlan, Inc.
PITTSBURGH, Dravo Corp., Keystone Division
PHOENIX, Ariz., Kircher Asbestos & Rubber Co.
RALEIGH, N. C., Southern States Iron Roofing Co.
RICHMOND, Va., Southern States Iron Roofing Co.
ROCKFORD, Ill., Mott Brothers Co.
SALT LAKE CITY, Bullough Asbestos Supply Co.
SAN ANTONIO, The Bracken Co.
SAN DIEGO, Western Fibrous Glass Products
SAN FRANCISCO, Western Fibrous Glass Products
SAVANNAH, Ga., Southern States Iron Roofing Co.
SEATTLE, Western Fibrous Glass Products
ST. LOUIS, A. G. Brauer Supply Co.
ST. PAUL, Asbestos Products, Inc.
SYRACUSE, N. Y., Industrial Supply Co.
TAMPA, Fla., Eagle Roofing & Art Metal Works, Inc.
TALLAHASSEE, Fla., Capital Refrigeration & Supply
TULSA, Okla., Ball Distributing & Engr. Co.
TUPELO, Miss., Paine Supply Co.
WASHINGTON, Walter E. Campbell Co., Inc.
WICHITA, Jamar-Olmen Construction Co.
VANCOUVER, B. C., Fleck Brothers Limited

GUSTIN gb BACON

EQUIPMENT DEVELOPMENTS

Continued

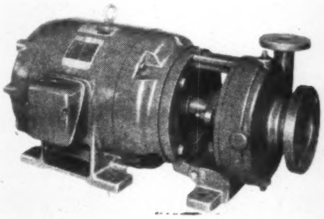
rapid assembly prohibits use of braided or extruded type material. Serviceable for temperatures −150 to 500 F, says company. In sizes $\frac{1}{4}$ to $\frac{3}{4}$ in. on 10, 20 ft and larger spools. Bulk form in 1 lb cans.



Time Switches . . .

. . . for commercial defrosting—*Tork Time Controls, Inc., Dept. HPAC, Mt. Vernon, N.Y.*

"Triple-Action" series units are said to offer not only "exact" control and operational efficiency in defrosting, but provide savings in service and maintenance. Available in models for use with various methods of defrosting. Equipped with heavy duty synchronous motor and gear train which operates at temperatures −40 to 140 F.

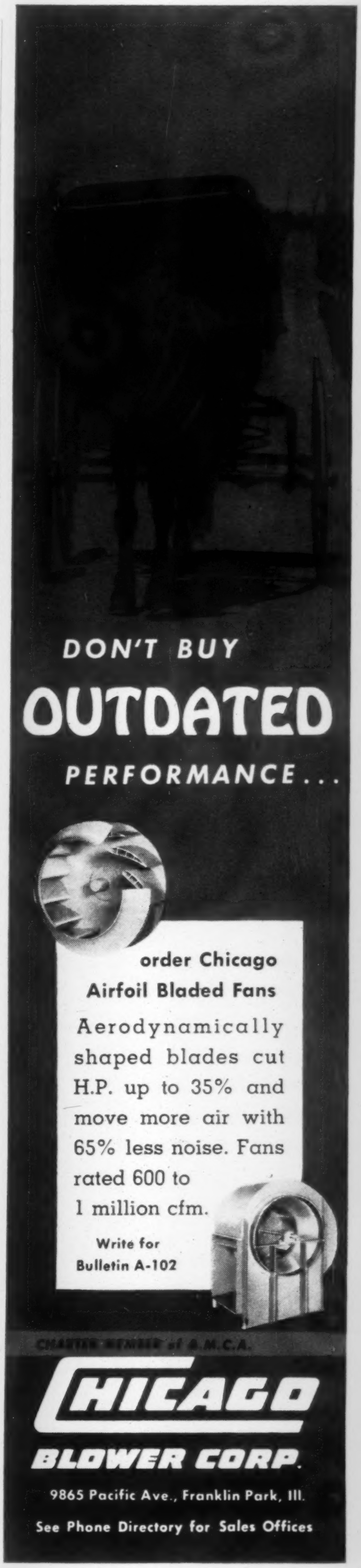


Centrifugal Pumps . . .

. . . engineered to conserve space, investment—*Dean Bros. Pumps, Inc., Dept. HPAC, 323 W. 10th St., Indianapolis 7.*

Type "GSC" close coupled units recommended for applications where conditions do not require more costly "engineered" pump, manufacturer states. Line comprises seven units

(*Continued on page 220*)



DON'T BUY

OUTDATED

PERFORMANCE . . .

order Chicago Airfoil Bladed Fans

Aerodynamically shaped blades cut H.P. up to 35% and move more air with 65% less noise. Fans rated 600 to 1 million cfm.

Write for Bulletin A-102

CHARTER MEMBER of A.M.C.A.

CHICAGO BLOWER CORP.

9865 Pacific Ave., Franklin Park, Ill.

See Phone Directory for Sales Offices

NEW

from K&M best in asbestos®

KaytherM®

PIPE INSULATION

Highly efficient from 250° F. to 1350° F.

LIGHT IN WEIGHT *for easiest handling.*
EXTRA STRONG *to allow for job pre-fabrication.*
DIMENSIONAL STABILITY *helps prevent expansion-caused leaks.*
INSOLUBLE IN WATER, CHEMICALLY STABLE. *Ideal for outdoor use.*

Years of research by Keasbey & Mattison, insulation pioneers, have resulted in a new, highly efficient, pipe insulation made of lime and silica (hydrous calcium silicate) with asbestos fibers added for strength. It's called KaytherM and it's strong, light in weight, and easily handled and cut.

KaytherM Pipe Insulation comes in simplified thicknesses and in pipe sizes up to 33″ in diameter. KaytherM is also available in block form.

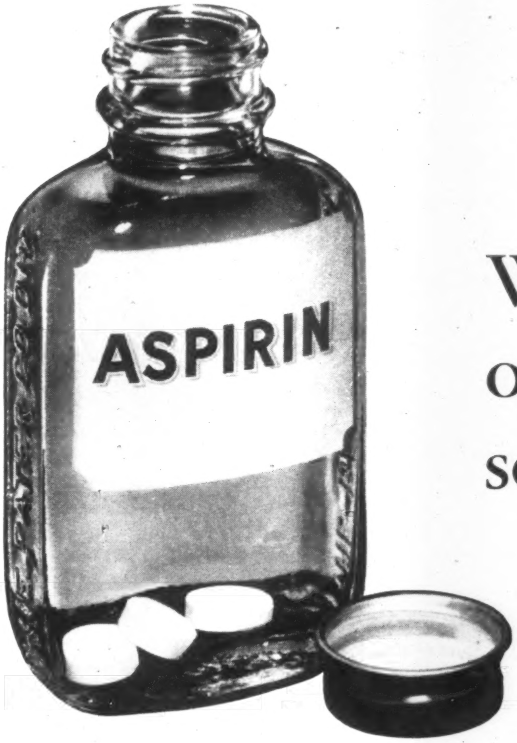
AVERAGE PHYSICAL CHARACTERISTICS—(Bone Dry Basis)

Temperature limit	1350° F.
Density, lbs./cu. ft.	11.5
Modulus of Rupture, lbs./sq. in.	65
"K" Factor at mean temperatures	100° F.—0.330 400° F.—0.465 800° F.—0.650

Write to us for full descriptive literature.

KEASBEY & MATTISON COMPANY • AMBLER • PENNSYLVANIA

ENGINEERS WANTED—Career opportunities open for men qualified in product development, machine design, automation, plant management, plant engineering and applied research. Write to Director of Engineering, Keasbey & Mattison Company, Ambler 4, Pa.



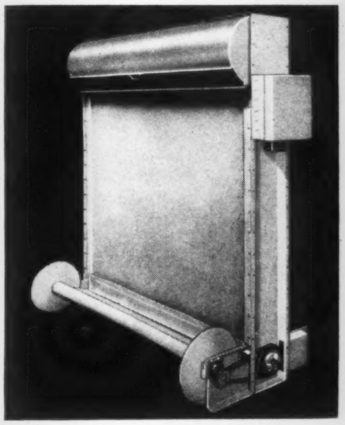
We had our headaches so you wouldn't!

The AAF Roll-O-MATIC air filter features *built-in* trouble-free operation

THE idea of the Roll-O-Matic air filter seemed simple enough. The *idea* was . . . but development and perfection *were not*. The goal of positive automatic operation plus simple, once-a-year maintenance offered some thorny problems.

To reach that goal, AAF developed Roll-O-Mat—the "miracle" filtering material of fluffy, bonded glass fibres that compresses to paper-like thinness on the roll. That's not all. The Roll-O-Matic also required a specially-compounded viscosine (for pre-charging media) that retained its jelly-like consistency under a wide range of temperature and humidity conditions . . . without being sticky to handle on the roll.

Your response to the AAF Roll-O-Matic has proven that it's worth a lot of headaches to be able to offer a headache-free air filter. For complete details on the *one-and-only* Roll-O-Matic, call your nearest AAF representative or write direct for Bulletin 248A.



AAF American Air Filter
COMPANY, INC.
herman nelson
373 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

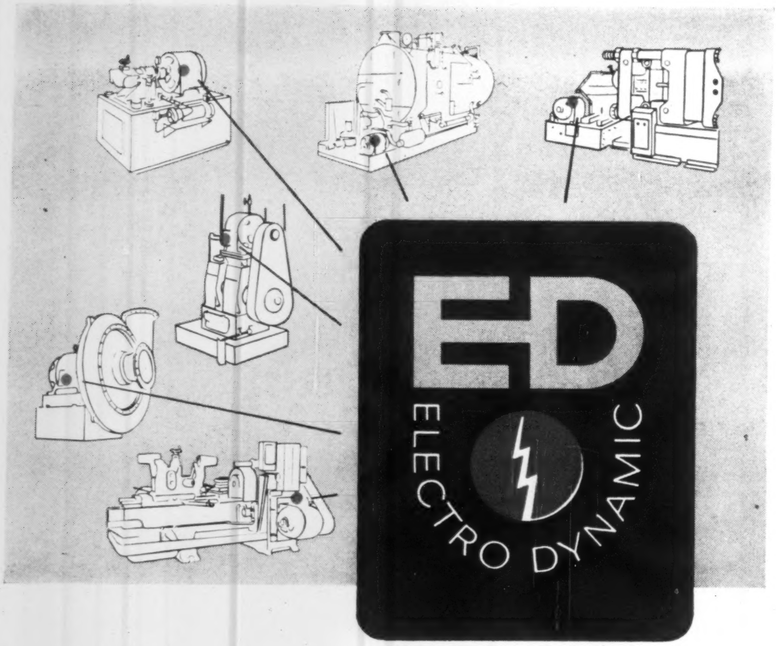
AAF Dust Control Equipment

Illinois Heating Specialties

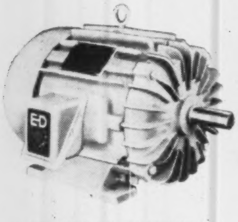
— BETTER AIR IS OUR BUSINESS —

Herman Nelson Unit Heaters

Herman Nelson Unit Ventilators

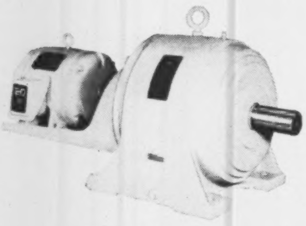


THIS EMBLEM IDENTIFIES
EXTRA DEPENDABLE
INDUSTRIAL MACHINERY



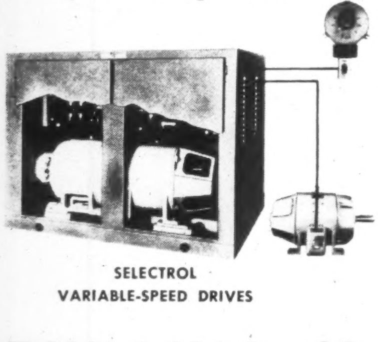
STANDARD MOTORS

The red *power spot* on industrial machinery means "Powered by Electro Dynamic." Such machinery relies with confidence on the *extra dependability* of Electro Dynamic motors, the proven industrial motors which give industrial equipment *extra dependable* operation.



GEAR-ED-MOTORS

SELECTRON
VARIABLE-SPEED DRIVES



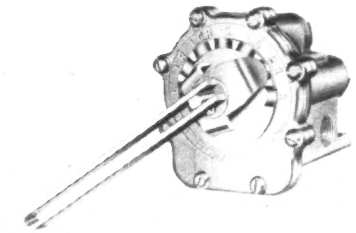
SELECTROL
VARIABLE-SPEED DRIVES

ELECTRO DYNAMIC
DIVISION OF GENERAL DYNAMICS
CORPORATION
BAYONNE, NEW JERSEY

EQUIPMENT DEVELOPMENTS

Continued from page 217

with capacities to 600 gpm, total dynamic head to 275 ft. Temperature range of liquids that can be pumped is −40 to 250 F.



4-Way Selector Valve . . .

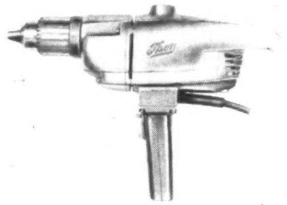
. . . for control of liquid flow to multiple spray manifolds or feed lines—*Spraying Systems Co., Dept. HPAC, 3219 Randolph St., Bellwood, Ill.*

"TeeValve" designed for accurate control, flexibility. Three outlet connections provided and flow through one or combination is obtained by setting control lever. Unit supplied in choice of $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$ in. NPT outlet connections.

Set Screw . . .

. . . with "self locking" feature designed to eliminate need for precise tapping—*Set Screw & Mfg. Co., Dept. HPAC, Bartlett, Ill.*

"Crest-Lok" utilizes locking action provided by unthreaded portion of crest. Advantages are that amount of locking action can be controlled by changing tap drill diameter; that re-use does not appreciably affect locking action, says company.



Electric Drills . . .

. . . in lighter, but more powerful series—*Thor Power Tool Co., Dept. HPAC, 175 N. State St., Aurora, Ill.*

In sizes $\frac{5}{8}$ to 1 in. New "EN" series supersedes company's former

from "Chicago"

A SPECIFIC TYPE OF PUMP

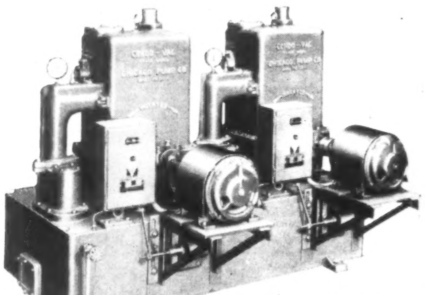
IN
CHICAGO PUMP CO.

for every Steam Heating System

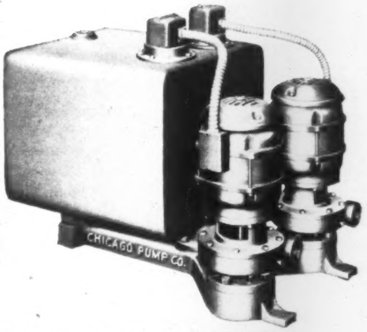
There's a Chicago Pump specifically designed for every type of building service steam heating system. No type of system has been overlooked by our engineers. *For any unusual condition: for below floor returns: for low vacuum systems: for small capacity, high pressure requirements: or for any standard system* . . . there is a Chicago Pump specifically designed 100% for the job. That means, there's no longer any reason for installing a pump that's not 100% suited to meet your needs. And you can be sure with a Chicago Pump that all ratings and receiver capacities meet or exceed standards of the American Society of Heating and Air Conditioning Engineers.

Write for details and free survey of your steam heating, pump requirements.

At left the TYPE AVC CONDENSATION PUMP & RECEIVER—Heavy cast iron receiver with low inlet for floor mounting or shallow pit. Cap. 500 to 10,000 EDR. Pressure 10-30 lbs.



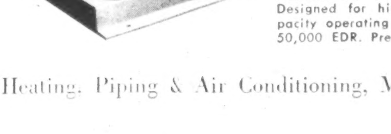
DUPLEX CONDO-VAC RETURN LINE VACUUM AND BOILER FEED PUMP—Designed for vacuum heating systems. Water content remains constant up to boiling point. Cap. 2500 to 150,000 EDR. Pressure to 40 lbs.



SURE RETURN CONDENSATION PUMP & RECEIVER — Condensate flows by gravity from receiver through base to pump. Available in single or duplex units. Cap. up to 75,000 EDR. Pressures, low or medium.

CHICAGO PUMP CO

TYPE CLLI VERTICAL CONDENSATION PUMP & RECEIVER—Designed for low return service and underground installations. Cap. 1000 to 40,000 EDR. Pressures 10 to 25 lbs.



DUPLEX EC CONDENSATION UNIT — Designed for high pressure, small capacity operating conditions. Cap. up to 50,000 EDR. Pressures up to 150 lbs.

CHICAGO PUMP COMPANY
Subsidiary of Food Machinery and Chemical Corporation
BUILDING PUMP DIVISION
622 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

Condo-Vac ®, Sure Return ®, AVC, LVC, Fire, House & Circulating Pumps, Pneumatic & Tankless Water Systems . . Flush Kleen ® Sewage Ejectors, Little Giant ® & Non-Clog Bilge Pumps, Pumps for every Industrial use

Mettler "FAN-AIR" Gas Burners chosen for unusual boiler installation

Here's the difference . . .

Unique Mettler "ENTRAINED COMBUSTION" design. Wide "turn down range" without backfiring. Four orifices per port (instead of the usual one), means top efficiency. Orifices are *replaceable*, too.

Functional use of color improves working conditions and actually makes this boiler room an attractive "show place." Choice of "FAN-AIR" Gas Burners for the boilers upgrades working conditions, too, because they're quiet . . . clean firing . . and safe! Safety is a standout feature of Mettler Burners. Their exclusive pilot rectification control system is a newer, more advanced method of safeguarding burners. Another "FAN-AIR" *first* is replaceable gas orifices . . . a feature that permits engineering the size of the orifice to each job, matching available gas pressure to desired input for ultimate in air-gas mixing. This gives you completely flexible application (with mechanical or natural draft) and maximum *efficiency* . . . at real money saving low cost. Write for literature and specifications, today.

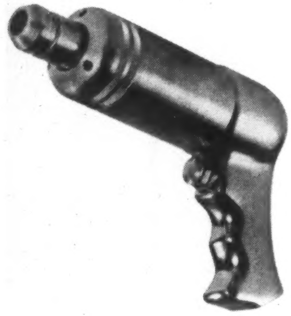
THE METTLER CO., INC.
Division of ECLIPSE FUEL ENGINEERING CO.
4366 Worth Street, Los Angeles 63, California

METTLER
Eclipse

EQUIPMENT DEVELOPMENTS

Continued

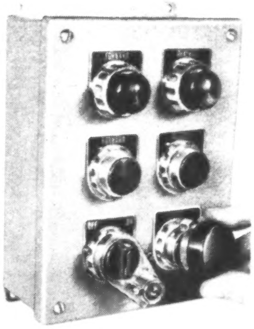
"UF" series. Are said to be shorter, more compact, more streamlined; more efficiently operated.



Air Hammer . . .

. . . with "impact control" feature *E.V. Nielsen, Inc., Dept. HPAC, 129 Broad St., Stamford, Conn.*

Feature gives full range control—from light tap to smashing blow—making it possible to use more than 10 tools and accessories, says company. Control trigger button regulates force of blow. Safety component provides that action will not start until tool itself touches work.



Pushbuttons . . .

. . . designed for accessibility of wiring, flexibility—*Furnas Electric Co., Dept. HPAC, Batavia, Ill.*

"Oil Tight" units rated to 550 volts a-c/d-c. Because of standardization and interchangeability, more combinations available with fewer parts, says company. New line includes pushbuttons, selector switches, selector pushbuttons, pilot lights, accessories. Units built around one standard contact block.

SOUND-ELEC TEST
CHAMBER

Sound-Elec Test Chamber where every Jenn-Air Unit is tested.

QUIET-TESTED EXHAUSTERS

"Given the Works" BY JENN-AIR SOUND-ELEC TEST CHAMBER!

Only Jenn-Air Quiet-Tested Exhausters are pre-proved under simulated field conditions. Before leaving the factory, each unit must pass rigid inspection by the critical "Vibronic Eye" . . . each is screened in Jenn-Air's Sound-Elec Test Chamber to detect noise, vibration, and structural weakness. In Jenn-Air Exhausters, U-Springs suspend the power assembly—isolate it from the base of the unit. Motor and blade are balanced together, as a safeguard against vibration and noise. Result: the quietest exhausters on the market. How about maintenance cost? There is virtually no upkeep on Jenn-Air Exhausters. Installation is easy and inexpensive. Ball bearing motors are lubricated for 10 years of normal operation. Spun-aluminum, rust-proof exhausters never need painting.

Jenn-Air Low-contour Roof Exhausters, unlike most industrial-type ventilators, live in architectural harmony with modern roof lines.

Jenn-Air Wall Exhausters—architecturally-sculptured button design spots ventilation control.

JENN-AIR PRODUCTS COMPANY, INC.

1102 Stadium Drive • Indianapolis 7, Indiana

For Commercial Installations

"Fabrikated"® WALL GRILLES

MADE TO ORDER IN SPECIAL LARGE SIZES

No. 311D WALL GRILLE

Independent famous "Fabrikated" construction makes these grilles especially adaptable to large sizes for schools, hospitals, hotels, and other commercial buildings.

CHECK THESE FEATURES:

- ✓ Vertical or horizontal bars strengthened by interlocking cross bars; no vibration.
- ✓ Tamper-proof. Changes in air distribution cannot be made by unauthorized persons.
- ✓ Mesh (3/8 x 1 11/16) filters 72% of free area yet darkens the duct and reduces highlights from back of the grille.
- ✓ 14 gauge steel solid bars ½" deep—strong enough to be "kick-proof"—(a must for schools).
- ✓ All bars made from round edge stock. No sharp edges. (A must for schools).
- ✓ The only grille for taking abuse in school gyms and hospital psychopathic wards.

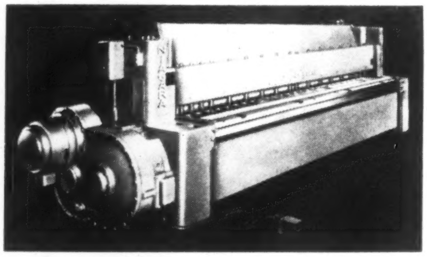
These grilles are unusually rigid-strong and exceed ingly resistant to impact—the best that money can bu We make them in any size. Send your specification We are prepared to give immediate service becau we always stock grille parts for any size.

THE INDEPENDENT
REGISTER CO.
3747 E. 93rd STREET • CLEVELAND, OHIO

Forced Convection Heater . . .

. . . with 115,000 Btu per hr input—*Norman Products Co., Dept. HPAC,* 1150 *Chesapeake Ave., Columbus, Ohio.*

Gas fired, overhead units recommended by company for modern stores, shops. Cited feature is sealed combustion system with automatic electric ignition—makes operation of "Three-Sixty" independent of room air and eliminates problem of pilot outage, says company. Combustion air drawn from outside building through separate inlet pipe. Exhaust gases vented to outside through parallel separate pipe.



Power Squaring Shears . . .

. . . redesigned with new features, optional accessories —*Niagara Machine & Tool Works, Dept. HPAC,* 683 *Northland Ave., Buffalo* 11.

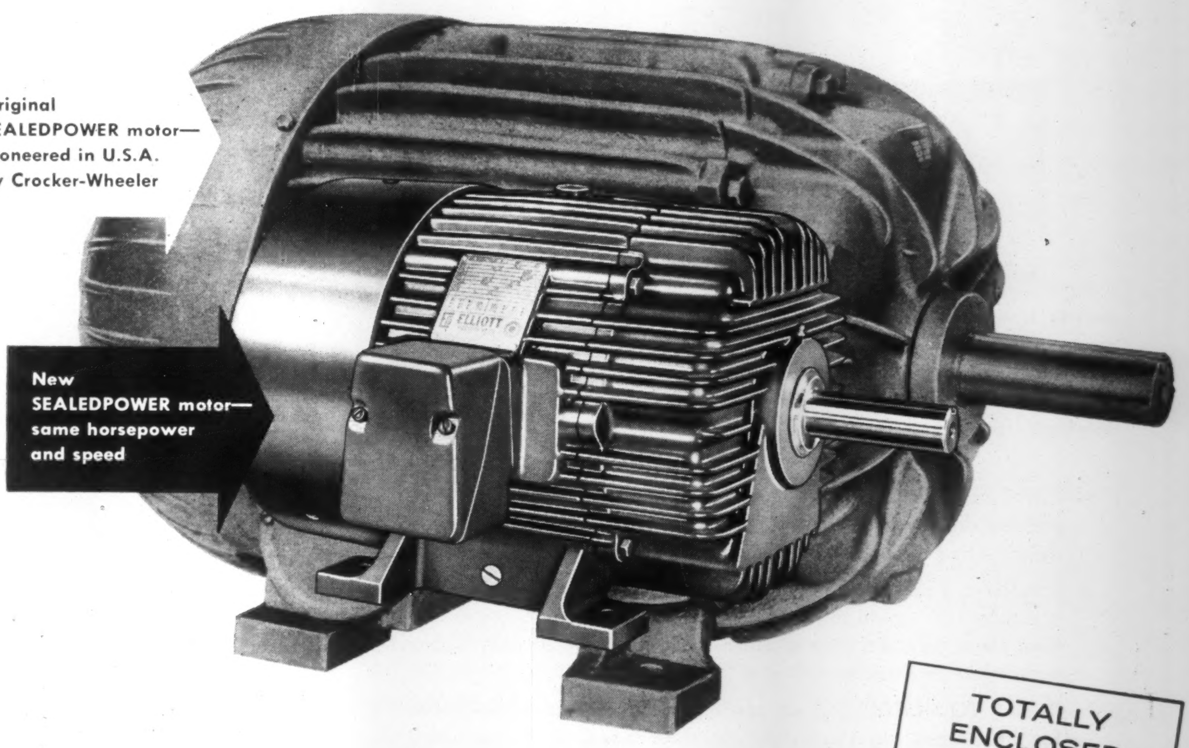
Engineered to speed up production, maintain accurate cutting performance. Features include, says company: hinged back gage angle; adjustable, parallel micrometer back gage; light beam shearing gage; disappearing adjustable stops; remote control electric foot switch; stationary safety guard. Line includes 59 models with capacities ranging 16 gage to 1 in. mild steel, cutting lengths 4 to 20 ft.

Packaged Air Conditioning . . .

. . . equipment in five lines to be added to company's products—*Drayer-Hanson, Div. of National-U.S. Radiator Corp., Dept. HPAC,* 3301 *Medford St., Los Angeles* 63.

One line will be six-model series of air conditioners for commercial applications in 7½, 10, 15 ton sizes

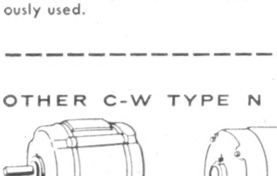
Inside and Outside . . . entirely



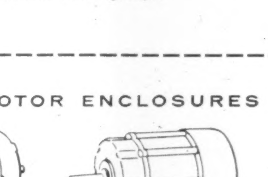
TOTALLY
ENCLOSED
FAN-COOLED
FRAMES
284U-326U

NEW Elliott SEALEDPOWER Motors Produce MORE POWER per POUND

Superior Insulation Improves Motor Performance



Stator slots are lined with new, revolutionary synthetic materials having greater dielectric and mechanical strength than those previously used.



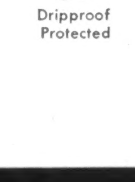
Motor coils are group-wound from continuous lengths of Vinylastic wire, with no brazed or soldered connections within groups.

In the new Elliott Crocker-Wheeler Type N motors, better utilization of copper, insulation, and electrical steel produces more horsepower per pound than earlier designs.

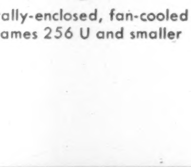
This is one of the *balanced design* factors that contribute to the outstanding performance of these motors. Others are highest quality electric steel, rigid frames and brackets, choice of anti-friction bearings to suit your operating and maintenance conditions, and a variety of highly effective enclosures, including dripproof, totally-enclosed and explosion-proof designs.

OTHER C-W TYPE N MOTOR ENCLOSURES

Totally-enclosed
non-ventilated



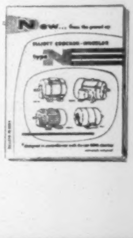
Dripproof
Protected



Totally-enclosed, fan-cooled
Frames 256 U and smaller

ELLIOTT Company

CROCKER-WHEELER DIVISION



WRITE **for new bulletin describing Elliott C-W Type N Motors. *Address:* Elliott Company, Crocker-Wheeler Division, Jeannette, Penna.**

W6-7

Four Good Reasons for Specifying

GOODALL
EXPANSION JOINTS

Because they are made of rubber, Goodall Expansion Joints have certain advantages stemming from rubber's natural characteristics. Among these are the following:

1—LONGER SERVICE LIFE. Continuous movement during expansion and contraction actually keeps the rubber joint "alive". There is no deterioration through embrittlement or corrosion.

2—SENSITIVE RESPONSE TO PRESSURE. Only the slightest pressure is required to create movement in the rubber joint, in any direction. Stress on metal pipe or other connected member is therefore reduced to an absolute minimum.

3—EASIER TO INSTALL . . . on new construction or as replacements for other types. Light in weight . . . short face-to-face dimensions . . . retaining rings or flanges quickly aligned and bolted. No gaskets required.

4—AVAILABLE IN "FLANG-LOK" STYLE . . . a patented Goodall development which provides exceptional ease of installation; a far greater sealing face area than the standard right-angle style; and a seal that is completely non-metallic.

* * *

Goodall Rubber Expansion Joints are custom-built to meet specific requirements in sizes from 3/8" I. D. to 96" I. D., for pressures up to 125 lbs. P.S.I. and/or vacuum. They are available in Right Angle and Sleeve Types, as well as "Flang-Lok"; single or multiple arch; tapered; offset; and rectangular.

* * *

Send for Illustrated Booklet, or Contact Our Nearest Branch

"If it's GOODALL, it MUST be Good!"

Standard of Quality—Since 1870

HOSE • BELTING • FOOTWEAR • CLOTHING
AND OTHER INDUSTRIAL RUBBER PRODUCTS

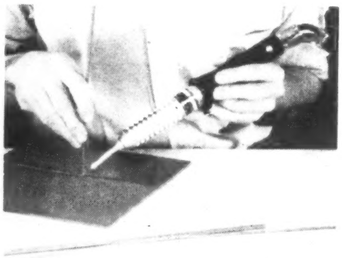
GOODALL Rubber Company

GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.
Branches and Distributors Throughout the United States and in Canada

EQUIPMENT DEVELOPMENTS

Continued

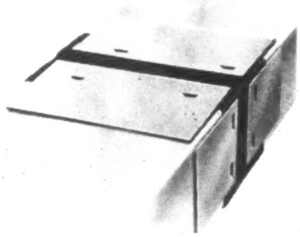
featuring oversize blowers, cleanable air filters, water cooled condenser with finned tube coil construction. Other lines will include models with capacities 2 to 7½ tons, and a series for industrial and large commercial applications rated 7½ to 60 hp. Two types of water chillers to be offered rated 7½ to 75 hp.



Plastic Welder . . .

. . .designed to cover welding requirements of thermoplastic materials from thin polyethylene sheet to heavy polyvinyl chloride—*Seelye Craftsmen, Dept. HPAC, 984 Central Ave., Minneapolis.*

Engineered for operation by maintenance personnel with no special training. Normally equipped with 320 watt heating element, but 180, 240, 600 watt elements available.



Ductwork Fastening . . .

. . .process designed to save time of installation—*Metalace & Stitch, Inc., Dept. HPAC, 255 Fifth Ave., New York.*

"Metalace" is one-step process that "buttons" two pieces of metal together without use of bolts, rivets, solder, staples, other materials. By using proper punch and die set, two elements are quickly, economically "laced" together, says company.

WHY SUFFER FROM

"STANDARD CATALOG UNIT"

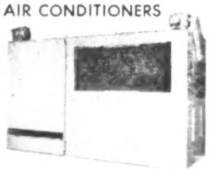
HEADACHES?

"SATISFABRICATED" AIR CONDITIONING UNITS

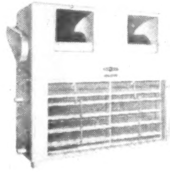
BY GOVERNAIR

WILL FIT YOUR JOB!

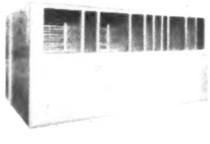
SELF CONTAINED
AIR CONDITIONERS



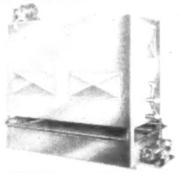
FAN & COIL UNITS



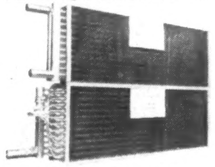
MULTI-ZONE
FAN & COIL UNITS



EVAPORATIVE
CONDENSER



COILS
HEATING & COOLING



When ordering packaged air conditioners, why should you inherit the headaches of fitting other manufacturers' unalterable "standard catalog" units to your needs?

Not when it's so easy to order "Satisfabricated" Governair units . . . completely self contained . . . completely flexible in design, to suit any particular load conditions or unusual space requirements. Governair "Satisfabricated" units operate with simple water, electrical and duct connections. Important, too, is the fact that Governair units are **engineered** better . . . and **built** better . . . to **operate** better, at minimum maintenance cost.

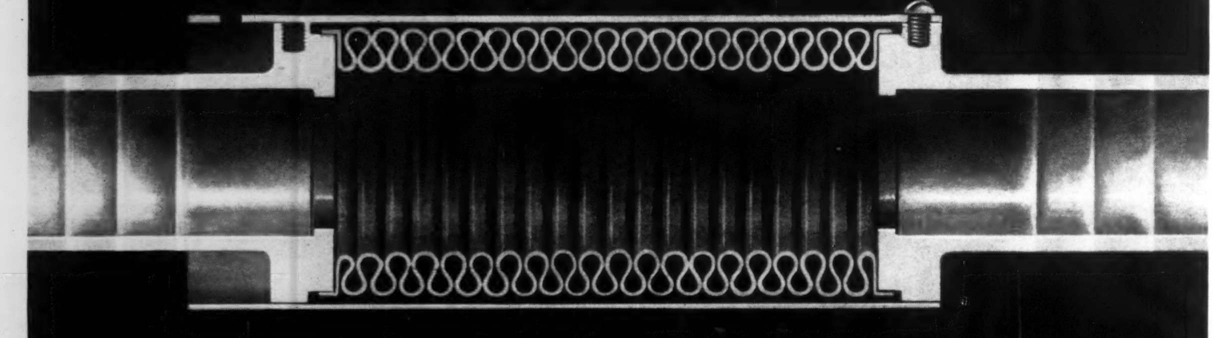
For more details, write the home office or refer to your classified directory for Governair's nearest representative.

GOVERNAIR CORPORATION
4840 NORTH SEWELL OKLAHOMA CITY, OKLAHOMA

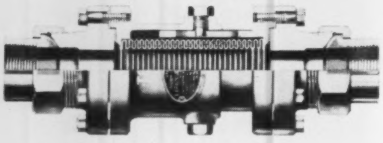
GOVERNAIR

ABSORB PIPE LINE EXPANSION

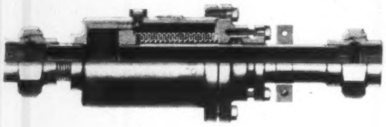
this trouble-free way



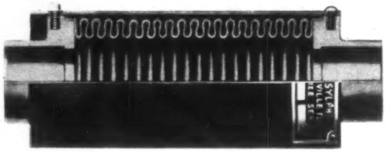
In absorbing the linear movement of steam and water lines, no method is more fool-proof and economical than the Fulton Sylphon Packless Expansion Joint. These Joints minimize installation and construction costs, eliminate packing maintenance, and maintain vacuum for economical heating. The reason is their exclusive Sylphon® bellows. With its two-ply *seamless* construction, this bellows gives utmost protection against leakage . . . Produced by cold-working, it also has greater resiliency for years of "stretching and squeezing."



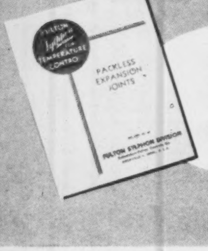
STEAM LINES No. 110-M Packless Expansion Joint absorbs expansion up to 1¼" in horizontal or vertical lines. Bellows made of Monel for extra strength and corrosion-resistance. Sizes 1" through 3". Steam or water pressures up to 100 psig. for some sizes.



WATER LINES No. 111-M Packless Expansion Joint allows for 1¼" expansion or contraction in hot water or chilled water lines. Features strong, corrosion-resistant Monel bellows plus emergency packing. Pressures to 100 psig, sizes ¾" through 3".



STEAM OR WATER No. 96066 is simple, compact. Absorbs expansion of "baseboard" radiation, finned connectors, horizontal or vertical supply lines, etc. ½" expansion capacity. Maximum pressure 40 psig, copper pipe sizes ¾" through 2".



SEND FOR CATALOG NO. 65-EH

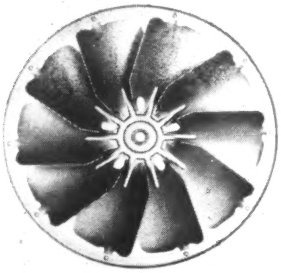
Robertshaw-Fulton®

CONTROLS COMPANY

Mr Controls

FULTON SYLPHON DIVISION

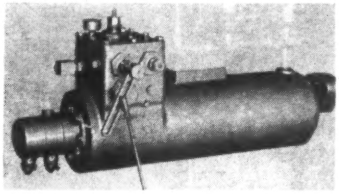
Knoxville 1, Tenn.



Slinger Ring Fans . . .

. . . with ten-blade design—*Torrington Mfg. Co., Dept. HPAC, Torrington, Conn.*

"C13-10" series engineered to save about 1 in. of axial depth in room air conditioners while matching air flow performance for six-bladed fans. One-piece, five-bladed series also available for applications where low initial cost is of prime importance. Both have slinger ring outer diameter of 14¼ in.



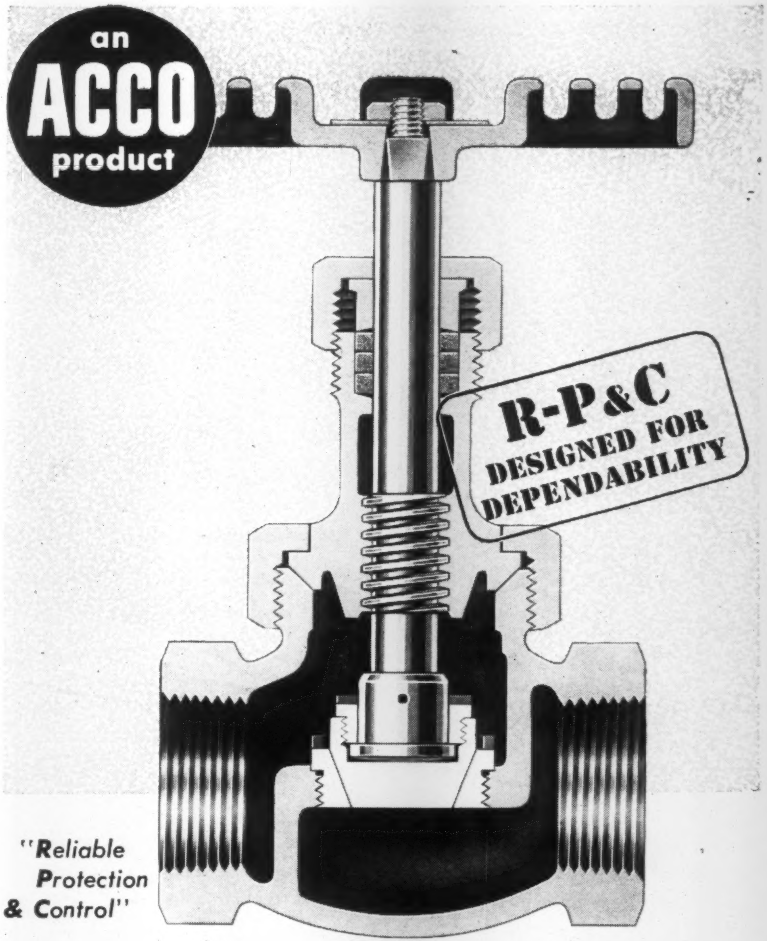
Heating System . . .

. . . designed to keep No. 6 oil in continuous circulation, compensate for variable viscosity, heat burner nozzle—*York-Shipley, Inc., Dept. HPAC, York, Pa.*

Operation of viscosity compensator made possible by fact that oil transfer pump will provide it with constant flow of oil, says company. Compensator consists of three chambers: oil inlet chamber receives oil from storage tank; oil outlet chamber returns unfired oil to storage; preheater chamber delivers oil of proper temperature to fuel tube.

Set Screws . . .

. . . for miniaturized equipment—*Set Screw & Mfg. Co., Dept. HPAC, Bartlett, Ill.*



"Reliable Protection & Control"

New R-P&C Bronze Globe Valve

—STAINLESS STEEL SEAT AND DISC (500 BRINELL)
—FULL-PLUG FOR CLOSER REGULATION, LONGER LIFE

R-P&C's new **Fig. 427-DP** bronze globe valve is recommended for steam, water, oil and gas service where control or regulation of flow is required. Its 500 Brinell stainless steel seat and disc resist wire-drawing—make it particularly suitable for continuous throttling and other severe applications.

- The Fig. 427-DP is packed with the quality features that users expect from R-P&C. For example, the union bonnet for added strength and convenience, and a disc and seat ring construction which permits regrinding without removing the valve from the line. The full-plug construction, with its exceptional wide seating surface, gives closer control, longer life.
- The Fig. 427-DP is rated for 300 lbs. Steam—1000 lbs. OWG in sizes ¼" to 2", and 600 OWG in sizes 2½" and 3". Also supplied as an angle valve. Precisely designed, it is a fitting addition to R-P&C's complete line of bronze valves—gates, globes, angles and checks, in pressure classes from 125 to 300 lbs. See your R-P&C Distributor or write for catalog.

ACCO

R-P&C Valve Division
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit,
Houston, New York, Philadelphia, Pittsburgh, San Francisco,
Bridgeport, Conn.

TRADE MARK

R-P&C valves

You can't block
EXPANSION
in heating systems . . .

SO CONNECTIONS MUST COMPENSATE

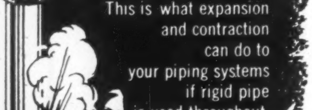
That's why Packless® is first and foremost in the design, engineering and manufacture of seamless metal flexible hose that

- *ABSORBS EXPANSION*
- *CONTROLS VIBRATION AND PIPE TRAVEL*
- *DAMPENS NOISE*
- *CORRECTS MISALIGNMENT*
- *PREVENTS PIPE DAMAGE*

A complete line of standard connectors, in sizes from ¼″ to 4″ I.P.S. are available for immediate delivery. Engineering service for *your* specific requirements is offered at no extra cost.

Call or write now for special technical bulletins or further detailed information. Please give us a general idea of your problem so that we may be of greater assistance to you.

Distributors and
Representatives wanted:
Some territories still open



PACKLESS
METAL HOSE INC. 31-12 Winthrop Ave., New Rochelle, N.Y.

Cited advantages: elimination of need for special design set screws, high precision, fully formed fine threads, uniformity for maximum contact with driving tools, special heat treating to give high tensile strength without brittleness or decarburization. In socket, socket cap, slotted styles, and in variety of points.

Vibration Mountings . . .

. . . in three sizes with load range 10 to 1250 lb per mounting—*Vibration Mountings, Inc., Dept. HPAC, 98-25 50th Ave., Corona, N.Y.*

Each size of neoprene-in-shear "Type R" units molded in four durometers (hardnesses) with each durometer in different color to prevent errors in selection and installation, says company.

Plastic Tubing . . .

. . . in sizes ¼ to 1 in. *Franklin Plastics, Inc., Dept. HPAC, Franklin, Pa.*

"Dur-X" polyethylene tubing available in two grades—translucent, known as "Supreme T," and plain black, identified as "Supreme B." Former recommended by company for applications in evaporative coolers, radiant heating systems, chemical and pharmaceutical plants, food processing operations. Latter is intended for more rugged jobs such as transmitting brine solutions, for air or gas lines, conduit or vent lines. In lengths 100 and 500 ft. Other lengths to order.

Leveling Instrument . . .

. . . featuring new target—*Engis Equipment Co., Dept. HPAC, 431 S. Dearborn St., Chicago 5.*

Target is made of hard fiber board, is finished in design of black

MAMMOTH NEW ARLINGTON TOWERS TAKES PLENTY OF HEATING!

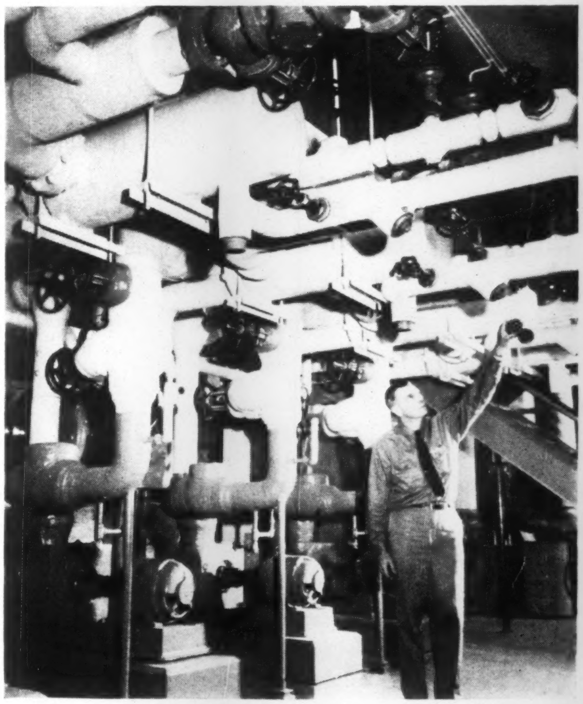
Arlington Towers, Arlington, Va., world's largest air-conditioned elevator type apartment project.

- *Cost:* $25,000,000
- *Architects:* G. V. Stone & D. H. Drayer, Washington, D. C.
- *Consulting Engineer for Heating:* General Engineering Associates
- *Mechanical Contractor:* W. H. Singleton Co., Inc., Arlington, Va.

...and 20 GENERAL Converters easily supply it for all 1684 apartments

Comfortable suburban living is the theme at beautiful new Arlington Towers Apartments. And an important part of the "comfort picture" is the heating of 869 efficiency apartments, 755 one-bedroom apartments, and 60 penthouses. GENERAL Converters do the job nicely. A compact bank of converters in each of the project's four spacious buildings provides high efficiency heat transfer from the steam lines to the circulating hot water system. There's always plenty of heat for each apartment.

This modern hot water heating system illustrates a typical application of GENERAL Converters in new apartment construction. Other successful installations of GENERAL Products are operating in all types of buildings from cottages to skyscrapers. Put GENERAL efficiency into *your* next job. Write for Catalog 61. General Fittings Co., Box 151E, East Greenwich, R. I.

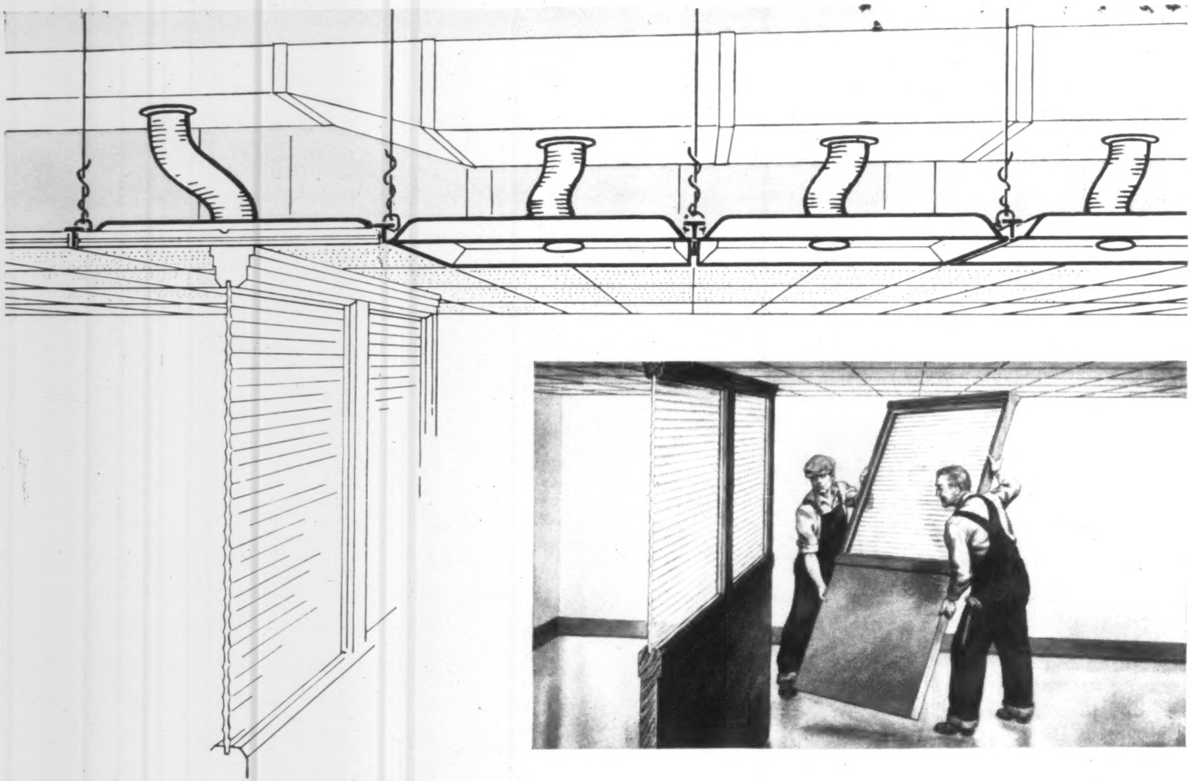


One of four centralized banks of steam-to-water GENERAL Converters that supply heat for Arlington Towers. Four of the five converters in each building supply 160°F water at 190 to 270 g.p.m. The fifth in each bank (not shown) supplies 200° water at 65 to 80 g.p.m.

GENERAL FITTINGS
COMPANY

Manufacturers of Instantaneous Water Heaters, Converters, Fuel Oil Heaters, and Heating Specialties

eliminates air conditioning problems when relocating partitions...



multi-vent®

LOW VELOCITY AIR DIFFUSERS

For architects and engineers designing air conditioned modular office space, Multi-Vent solves a troublesome problem. Multi-Vent air diffusing panels, once installed flush in the ceiling, need not be moved, altered in any way, or even adjusted when partitions are moved to suit tenants' changing needs.

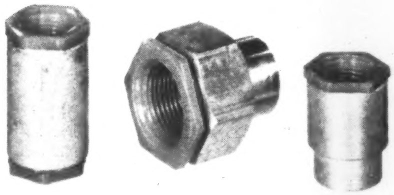
Since Multi-Vent introduces conditioned air through the perforations in standard acoustical ceiling pans at low velocity, and since the air is gently diffused downward into the room, there is no "throw" or "blow" to bounce off nearby partitions. It is for this reason that a partition may actually bisect a Multi-Vent panel without affecting comfort conditions in the surrounding area.

Write for detailed literature and name of representative in your area.

multi-vent division of THE PYLE-NATIONAL COMPANY
WHERE QUALITY IS TRADITIONAL

1373 North Kostner Avenue, Chicago 51, Illinois
SALES AND ENGINEERING REPRESENTATIVES IN PRINCIPAL CITIES OF UNITED STATES AND CANADA

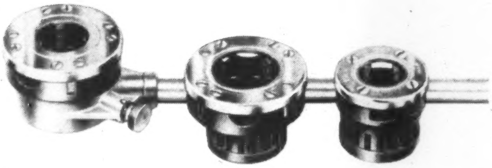
and yellow which is said to provide greatest accuracy and visibility in both close and distant leveling. Leveling instructions painted on back of target.



Dielectric Couplings, Unions . . .

. . . for iron pipe connections—*May Co., Dept. HPAC, Galesburg, Ill.*

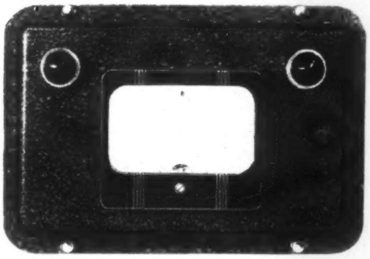
Available in both straight and reducing types, in sizes 3/8 to 2 in. Recommended by company for use wherever dissimilar metals are joined, to prevent electrolysis.



Drophead Ratchet Pipe Threaders . . .

. . . in two new models with segmental dies—*Erie Tool Works, Dept. HPAC, Erie, Pa.*

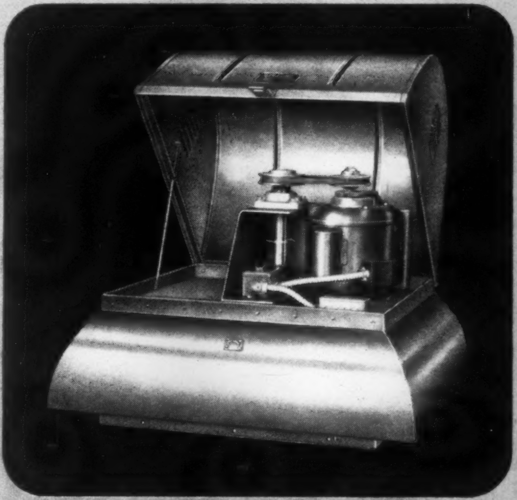
"No. 1PR" available in sizes 1/8 to 1¼ in. "No. 2PR" in 1/8 to 2 in. sizes. Die heads on "Pipemaster" units change quickly, yet cannot fall out, says company. Two-way ratchet provided, designed for easy back-off. Recommended by manufacturer for hand or machine operation.



Smoke Indicators, Recorders . . .

. . . with new design features—*Brooke Engineering Co., Inc., Dept. HPAC, 4517 Wayne Ave., Philadelphia 44.*

ALADDIN
Centrifugal
ROOF VENTILATORS



• THIRTEEN SIZES
• SELF CONTAINED
• QUIET OPERATING

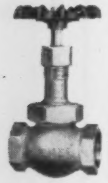
Certified Ratings
PFMA

ALADDIN Centrifugal Roof Ventilators are furnished in thirteen sizes . . . direct and belt driven. Ruggedly built, these units have been designed especially for those installations where positive year around powered ventilation is required.

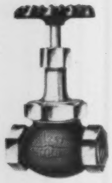
ALADDIN Roof Ventilators are described in the first complete engineering bulletin yet published on similar units. This bulletin contains full performance tables, characteristic curves and other data required for the proper selection of such equipment.

WRITE FOR BULLETIN 410

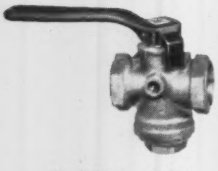
ALADDIN HEATING CORPORATION
1111 WEST AVENUE 137 • SAN LEANDRO, CALIF.
REPRESENTATIVES IN ALL PRINCIPAL CITIES IN THE WEST

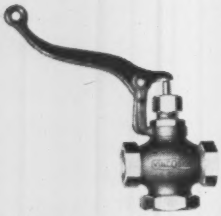

No. 107 Globe Valve

No. 1250 Gate Valve


No. 912 Globe Valve

No. 830 Stop Cock


No. 1296 Gas Cock


No. 840 Quick Operating Valve

DEPENDABLE
D.T. Williams
VALVES
are now
produced
by
DETROIT
CONTROLS

GUARDIANS OF THE PIPELINES
D.T. Williams
VALVES

This new association serves only to assure users of D. T. Williams Valves continued high quality and good service in the future as in the past. Direct orders and correspondence to D. T. Williams Valves, Detroit Controls Corp., 5801 Mariemont Ave., Cincinnati 27, Ohio.

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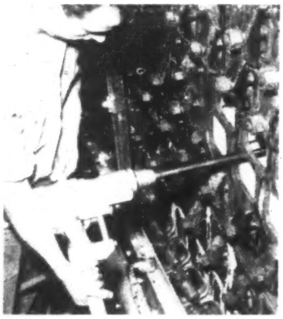
DETROIT CONTROLS
CORPORATION
Division of American-Standard

American-Standard Products

EQUIPMENT DEVELOPMENTS

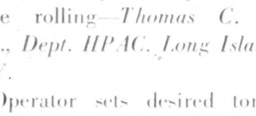
Continued

Case of indicator designed for flush or surface mounting. Red and green warning light as well as 4½ in. smoke meter provided. Warning lights indicate that smoke is out of bounds, and large smoke meter indicates color of flue gas. Operated by photo-electric cell mounted at boiler outlet. Smoke density translated to meter reading at remote location. Two types of indicator-recorders also offered.

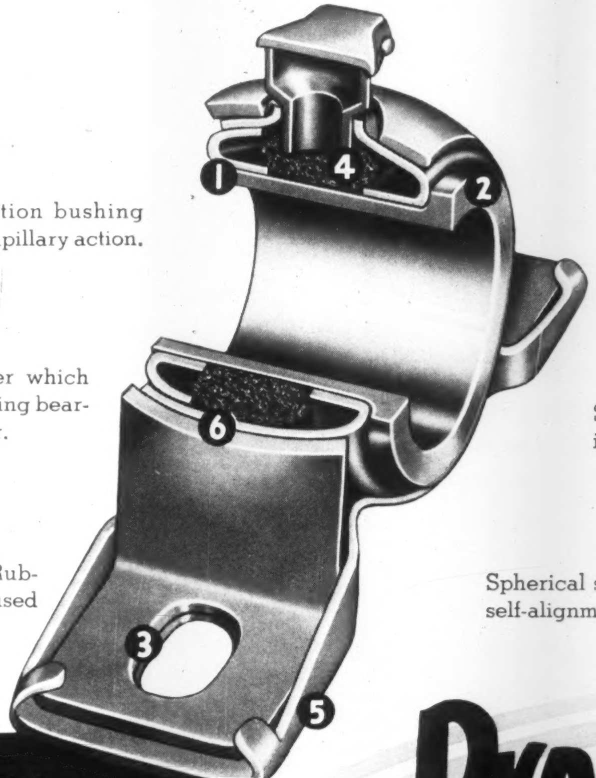


Expander Drive, Control . .
. . . with dial designed to provide control necessary for "precise" boiler tube rolling—*Thomas C. Wilson, Inc., Dept. HPAC, Long Island City, N.Y.*

Operator sets desired torque on "Model C Torq-Air-Matic" dial and starts rolling operation. When desired torque is obtained, expander automatically stops rotating, says company. Is said to provide uniform joint tightness, regardless of tube-sheet hole variation. For boiler tubes 1 to 2½ in. OD.



Vacuum Cleaners . . .
. . . for commercial, industrial, insti-



❶

Self-oiling composition bushing feeds oil to shaft by capillary action.

❷

Bushing has shoulder which provides self-lubricating bearing surface for collar.

❸

Slotted Bolt Holes. Rubber grommets can be used for sound isolation.

❹

Absorbent filler holds oil in reservoir and prevents over-lubrication.

❺

Split Pressed Steel Housing is light and strong.

❻

Spherical surfaces provide full self-alignment.

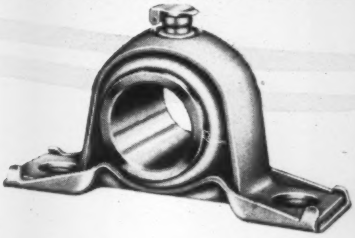
DODGE

Bronzoil

FAN AND BLOWER BEARINGS

Proved

in Millions of installations!



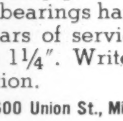
Engineered to meet the specialized requirements of fan and blower service, Dodge Bronzoil bearings are widely and successfully used on small shafts for general service, within the limits of their capacity. Capillary bronze bushing has a capacity of one-third its volume in oil. The liberal oil reservoir, with close fitting wick, surrounding the bushing provides ample lubrication. Millions of Bronzoil bearings have proved their dependability through years of service. Available in shaft sizes from ¾″ to 1¼″. Write now for literature and detailed information.

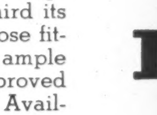
DODGE MANUFACTURING CORPORATION, 1600 Union St., Mishawaka, Ind.

DODGE

of Mishawaka, Ind.

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory-trained by Dodge, he can give you valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Machinery" in your classified telephone book.





Dodge-Timken Bearings

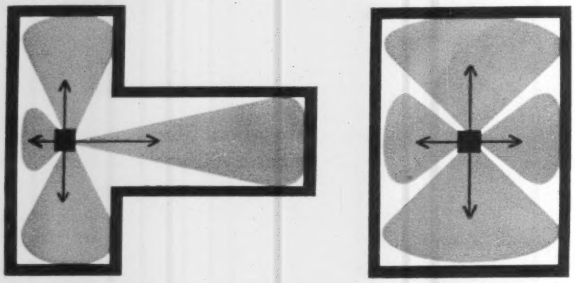
Taper-Lock Sheaves

Sealed-Life V-Belts

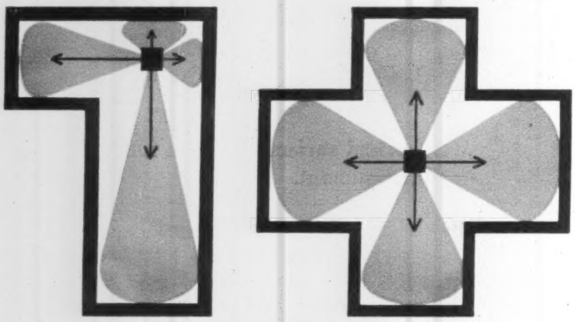
NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY,
CHICAGO THRIFT-ETCHING CORPORATION, 1555 N. SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS

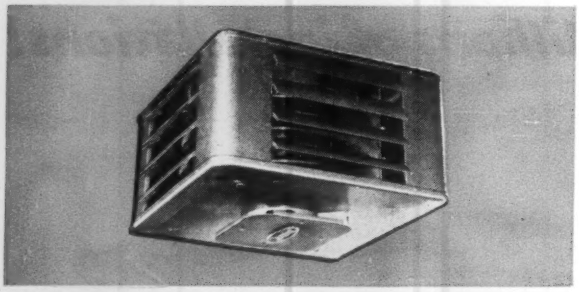
Carrier "Clover Leaf"



heating pattern adjusts



to any floor plan



Just one of Carrier's exclusive "Clover Leaf" Unit Heaters with variable 4-way air distribution effectively heats up to 8000 square feet of floor area. Carrier's greater, more flexible coverage means fewer units are needed, resulting in impressive savings in first cost, installation and upkeep. For steam or hot water, in 8 sizes: 55,000 to 600,000 Btu/hr.

For a complete catalog on the "Clover Leaf," call your Carrier manufacturer's agent. Look in the Classified Telephone Book under "Heaters—Unit." Or write Carrier Corporation, Dept. UH, Syracuse, New York.

Complete Line of Unit Heaters. Over 50 years' leadership in temperature control! Carrier knows heating!

Carrier

industrial heating • air conditioning • refrigeration

tutional uses—*Kent Co., Inc., Dept. HPAC, 716 Canal St., Rome, N. Y.*

For boiler cleanouts, removable head may be used in combination with company's "Drum-Seal" by setting head and "Drum-Seal" on ordinary drum or container.

Equipment Briefs . . .

RUBBER COMPOUND with nonsticking characteristic—*Goshen Rubber Co., Inc., Dept. HPAC, Goshen, Ind.* Recommended by company for valve seat, other applications. Is said to give quick breakaway without lubrication. For temperatures −40 to 300 F.

CONTROL SYSTEM designed to convert pneumatic signals into d-c current—*Fielden Instrument Div., Robertshaw-Fulton Controls Co., Dept. HPAC, 2920 N. Fourth St., Philadelphia* 33. Can then be reconverted to pneumatic pressure for actuating control valves, other equipment, says company. System recommended by manufacturer for low cost remote measurement, indication, recording, controlling of process variables.

ERECTION POLE for builders, installers—*Broad Crane and Engineering Service Co., Dept. HPAC, 779 S. Dumfries, Detroit* 17. "Blue Ox" is portable, 1 ton capacity unit. Recommended by manufacturer for erection of piping, conduit.

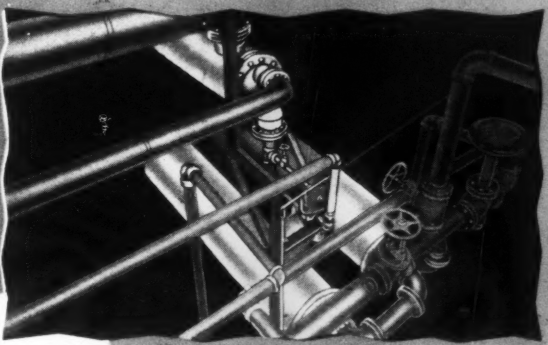
MAINTENANCE COATING formulated to resist corrosion, be easy to apply—*Metal & Thermit Corp., Dept. HPAC, Rahway, N.J.* Vinyl "Ucilon 1400" is said to resist acids, alkalies, water, other causes of early paint failure.

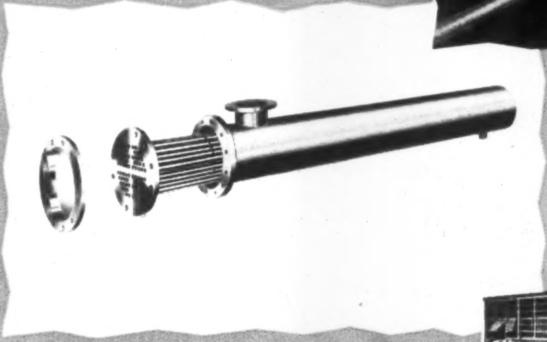
RUBBER-TO-METAL BONDING system designed to save in production costs—*Adhesives Div., B.F. Goodrich Industrial Products Co., Dept. HPAC, Akron, Ohio.* Called "Duolock," system combines primer with appropriate tie coats. For use on motor mounts, other applications.

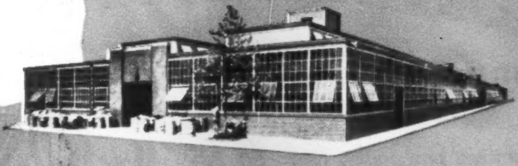
POURABLE CEMENT for holding anchor bolts—*Monroe Co., Inc., Dept. HPAC, 10703 Quebec Ave., Cleveland* 6. Facilitates fastening bolts in three easy steps, says company. These consist of preparing hole, placing bolt in position, pouring in fluid "Evr-Tite."‡

ENTIRE BUILDING NOW HEATED

WITH STEAM FORMERLY THROWN AWAY!







In this building a large industrial user of steam was dumping the condensate from their steam processing into a creek!

With the installation of the three Taco heat exchangers pictured, they are reclaiming enough steam to heat the entire 220′ x 560′ building.

Perhaps you, too, have a problem involving the use of heat exchangers such as for heating water; showers; cafeterias; processing; snow melting; heating elevated outdoor tank; swimming pools; feed water heaters; condensate cooling; heating buildings remote from the main plant. You are invited to write us concerning *any* heat exchanger problem or application.

BETTER HEATING Taco BETTER WITH TACO **TACO** **HEATERS INCORPORATED**
1160 CRANSTON ST., CRANSTON 9, RHODE ISLAND

Other Taco Quality Controlled Products

CIRCULATOR • 170 PUMP • MP PUMP • FLOCHEK • AIR-SCOOP • TACO-VENT • TEMPERING VALVE • VENTURI

Corporate Office: 342 Madison Ave., New York 17, N. Y. • In Canada: Taco Heaters of Canada, Ltd., 4 Gilead Place, Toronto 2

NEW PROCESS
assures improved pipe welds

announcing the ARCOS EB* WELD INSERT

To meet modern requirements for better pipe welds where high temperature, high pressure, and corrosive conditions exist, Arcos now offers the Consumable Weld Insert. Used for making the root pass, the EB Insert assures sound crevice free welds with smooth uniform inside contours. Saves money and time in fabrication . . . minimizes turbulence, and promotes trouble free service. Write for details. ARCOS CORPORATION, 1500 S. 50th St., Philadelphia 43, Pa.

*A registered trademark of the Electric Boat Division of General Dynamics Corporation.

RECENT TRADE LITERATURE . . .

▶ *ADAPTER FITTINGS*—Catalog 4360 shows straight thread plugs and adapters, o-rings for straight thread fittings, and steel and brass pipe fittings. Illustration, dimensional drawing, specification table presented for each item in line. *Tube & Hose Fittings Div., Parker Appliance Co., Dept. HPAC, 17325 Euclid Ave., Cleveland 12.*

▶ *AIR COMPRESSORS*—Line of 1/3 to 20 hp air compressors for industrial use detailed in 20 page catalog. Illustrated literature gives specifications on single and two-stage models, portable models, tanks, pumps, accessories. Charts, data, information on compressed air also included. *Kellogg Div., American Brake Shoe Co., Dept. HPAC, Rochester 9, N.Y.*

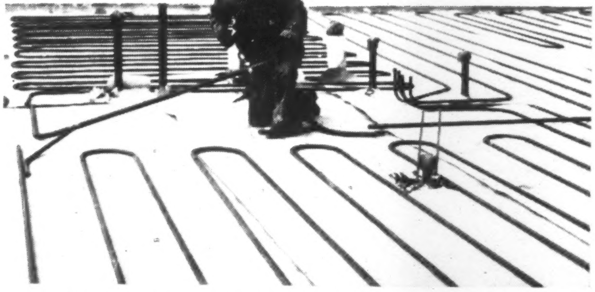
▶ *AIR COMPRESSORS*—Data sheet lists construction details, specifications of air compressors in 1/4 to 20 hp range. Is said to provide data useful in selecting right compressor for a specific job. *Brunner Mfg. Co., Dept. HPAC, 11 Fisher St., Utica, N.Y.*

▶ *AIR COOLED CONDENSING UNITS*—Two page bulletin No. 241 describes new 8 and 10 ton air cooled condensing units. Bulletin provides tables of specifications and ratings for both models. *Typhoon Air Conditioning Co., Div. of Hupp Corp., Dept. HPAC, 505 Carroll St., Brooklyn 15.*

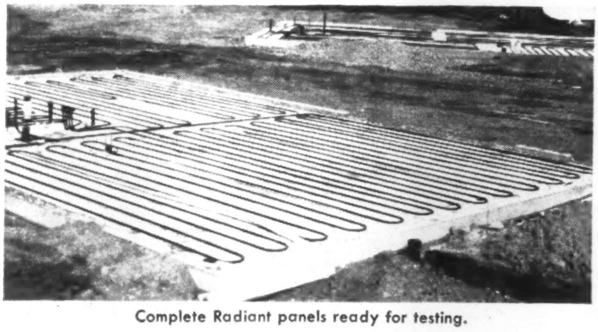
▶ *AIR HAMMER*—Information about "Ramex" air hammer, "Model AR-4," contained in 4 page catalog. Literature contains specifications of 4½ lb hammer said to be capable of 5400 blows per min. Also, 4 page price list provides drawings, specific size data about tools, accessories which can be used with hammer.

One thousand contemporary homes with truly "contemporary" steel pipe

RADIANT PANEL HEATING



Welding joints of steel pipe on the job for Radiant panels.



Complete Radiant panels ready for testing.

Gone are the attics and cellars and the in-between-floor inadequacies of yesterday in today's home building . . . replaced by contemporary designs with refreshingly new concepts of comfort and livability. Implementing these changes are wonderful new materials, construction methods, home equipment . . . and "invisible" radiant panel heating systems so perfectly suited to the modern building concept.

More than a thousand contemporary homes, by one builder alone, in the St. Louis area include steel pipe radiant heating systems that provide completely concealed radiation, more comfortable draft-free heat, unobstructed floor space and greater cleanliness.

Reliable, durable steel pipe has been the choice of this builder for all radiant heating systems in these $13,000 to $35,000 homes . . . standard since his first highly successful steel pipe radiant heating installation in 1947.

Yes, *Steel Pipe is first choice* for radiant heating, snow melting, fire sprinkler systems, plumbing, power, steam and air transmission lines. In fact, it is the most widely used pipe in the world!

Write for the free 48 page color booklet "Radiant Panel Heating with Steel Pipe".

Steel Pipe
is First Choice

Committee on
STEEL PIPE RESEARCH
AMERICAN IRON AND STEEL INSTITUTE
150 East Forty-Second Street, New York 17, N. Y.

Dependability—

...HOSPITAL GRADE!

TITUSVILLE

type WTP Steam Generators

The wide load variations encountered in hospital service are handled smoothly and dependably by the fully automatic, fully modulating features of Titusville's WTP Steam Generator. Shown are two Type WTP #12.5 units, serving a large eastern hospital with high efficiency over the entire operating range.

Write for your copy of the latest Titusville WTP Catalog

STRUTHERS WELLS PRODUCTS

BOILER DIVISION
BOILERS for Power and Heat . . . High and Low Pressure . . . Water Tube . . . Fire Tube . . . Package Units

PROCESSING EQUIPMENT DIVISION
Crystallizers . . . Direct Fired Heaters . . . Evaporators . . . Heat Exchangers . . . Mixing and Blending Units . . . Quick Opening Doors . . . Special Carbon and Alloy Processing Vessels . . . Synthesis Converters

FORGE DIVISION
Crankshafts . . . Pressure Vessels . . . Hydraulic Cylinders . . . Shafting . . . Straightening and Back-up Rolls

MACHINERY DIVISION
MACHINERY for Sheet and Structural Metal Forming . . . Tangent Benders . . . Folding Machines . . . Roller Table and Tumble Die Bending Machines . . . Press Brakes . . . Punching and Notching Machines . . . Forming Dies

THE Titusville IRON WORKS CO.
A Division of Struthers Wells *Corporation*

Titusville, Pennsylvania
Manufacturers of A Complete Line of Boilers for Every Heating and Power Requirement
Plants at Titusville, Pa. and Warren, Pa.
Offices in Principal Cities

RECENT TRADE LITERATURE

Continued

E. V. Nielsen, Inc., Dept. HPAC, 129 Broad St., Stamford, Conn.

▶ *ARC WELDING MACHINES*—Selenium rectifier and d-c motor generator arc welders for industrial welding, a-c and d-c engine driven arc welders for construction and maintenance, a-c transformer arc welders for plant and shop use are examples of line of welding machines illustrated and described in 44 page bulletin ADC 708C. Specifications included. *Air Reduction Sales Co., Div. of Air Reduction Co., Inc., Dept. HPAC, 150 E. 42nd St., New York.*

▶ *BOILER TUBE-EXPANDER CONTROL*—Bulletin 56-1 describes "Model C Torq-Air-Matic" air powered boiler tube expander drive and control. Advantages of precise tube rolling discussed and features of new device enumerated. *Thomas C. Wilson, Inc., Dept. HPAC, 21-11 44th Ave., Long Island City, N.Y.*

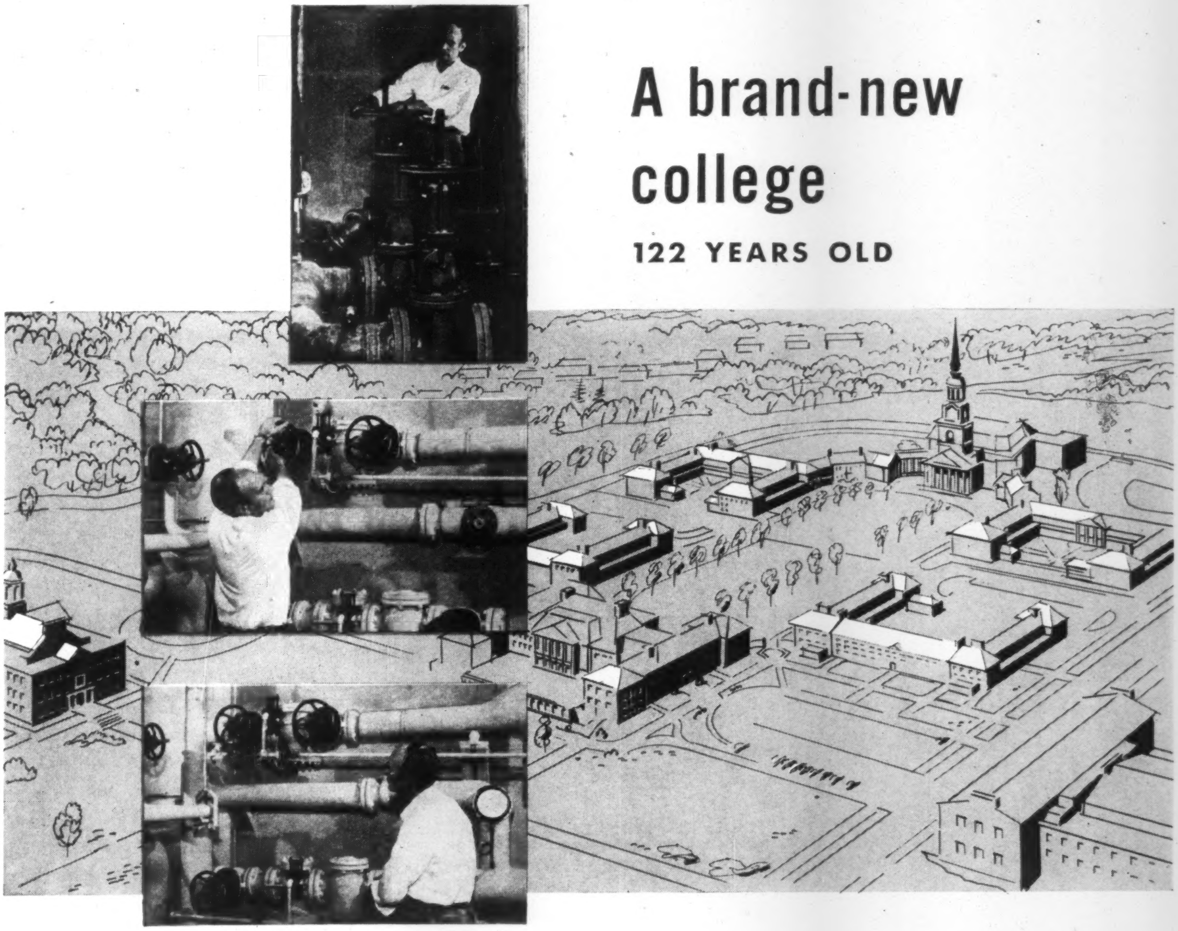
▶ *CEILING AIR DIFFUSERS*—New 8 page bulletin No. 390-F-57 describes line of low velocity ceiling air diffusers. Gives engineering data, diffuser selection data on new "Troffer" combination ceiling air diffuser and fluorescent light. *Multi-Vent Div., Pyle-National Co., Dept. HPAC, 1334 N. Kostner Ave., Chicago 51.*

▶ *COILS*—Design, price information on "Thermo-Panel" coils presented in bulletin No. 257. Product is not a pipe coil in usual sense, says company. Is formulated to take place of pipe coils for industrial heating, cooling processes. Literature gives sizes, prices of four different types. *Dean Thermo-Panel Coil Div., Dean Products, Inc., Dept. HPAC, 616 Franklin Ave., Brooklyn 38.*

▶ *COILS*—Single page form CEC-56 contains 15 pictures of "Thermo-Panel" coil, cites some of its applications in industry. Recommended by company for heating large cylindri-

A brand-new college

122 YEARS OLD



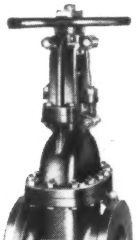
New Wake Forest College campus at Winston-Salem, North Carolina. In 27 of the new buildings OIC Valves have been used exclusively. According to H. S. Moore, Supt. of Buildings and Grounds, OIC Valves have never created maintenance problems for him in all his experience.

and you see OIC Valves everywhere!

Wake Forest College has been transplanted 110 miles from its original site to Winston-Salem, N. C. Its new campus consists of 28 sparkling, modified Georgian buildings, and everywhere you look everything is crisp and modern . . . from its beautifully designed quadrangle to its very last valve.

If you're ever close to Winston-Salem, visit Wake Forest College and enjoy this spectacle of modern design and construction techniques. You may see ideas you'll want to duplicate even down to the very last OIC Valve . . . the always modern, ever dependable, accepted valve line.

Architects: Larson & Larson, Winston-Salem, N. C.
Consulting Engineer: Louis Bouvier, Winston-Salem, N. C.
Materials Furnished by: Atlas Supply Co., Winston-Salem, N. C.

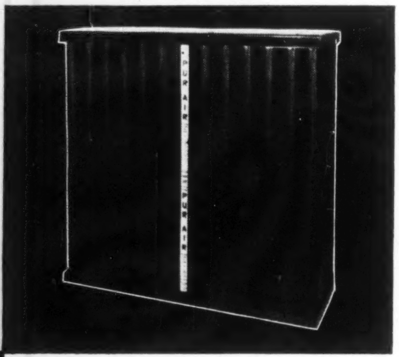


THE OHIO INJECTOR COMPANY
WADSWORTH • OHIO

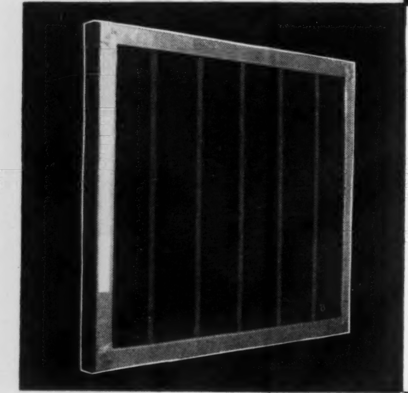
OIC
FOUNDED 1883
VALVES

FORGED & CAST STEEL, BRONZE & IRON, LUBRICATED PLUG VALVES

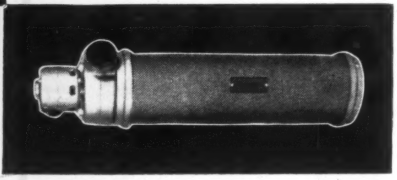
4 WAYS TO APPLY
Activated Charcoal
AIR PURIFICATION



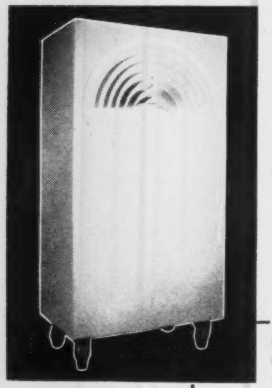
1. FilterFolds. For central system ductwork. Convenient size for any installation, new or existing. Give large air handling capacity in small space. Frames provided for cell bank mounting. Will purify and recover inside air for recirculation. Saves heating or cooling loads, provides clean, healthful atmosphere. For public buildings, plants, schools, hospitals.



2. Dacor. Stands for Disposable Activated Charcoal Odor Remover. Uses gridwork of Activated Charcoal coated fiber strips in paperboard frame. Recommended for air conditioners, forced air furnaces, ventilating systems. Dacors are light weight, have low resistance, can be installed in most equipment without mechanical change. For homes, restaurants, stores, offices.



3. Canister Circulator. Compact, self-contained air purifier, designed for small rooms or enclosed areas, such as lavatories, hospital rooms, reach-in coolers and laboratories, also research and testing.



4. Cabinet Circulators. Designed for rugged 24 hr.-a-day performance. Circulate and purify air in larger rooms, restaurants, offices, hospital wards, plants. Operate quietly, come fully assembled and ready to plug in. Handsome cabinets blend with any interior decor.

BARNEBEY-CHENEY
COLUMBUS 19, OHIO

Barnebey-Cheney HP3
Columbus 19, Ohio

Please send your catalog on applying Activated Charcoal air purification
My name ....
Address ....
Firm Name ....
City .... State ....

WRITE for
our catalog "Air purification by the Black Magic of ACTIVATED CHARCOAL."

RECENT TRADE LITERATURE

Continued

cal tanks from the outside, heating square tanks from both inside and outside. *Dean Thermo-Panel Coil Div., Dean Products, Inc., Dept. HPAC, 616 Franklin Ave., Brooklyn.*

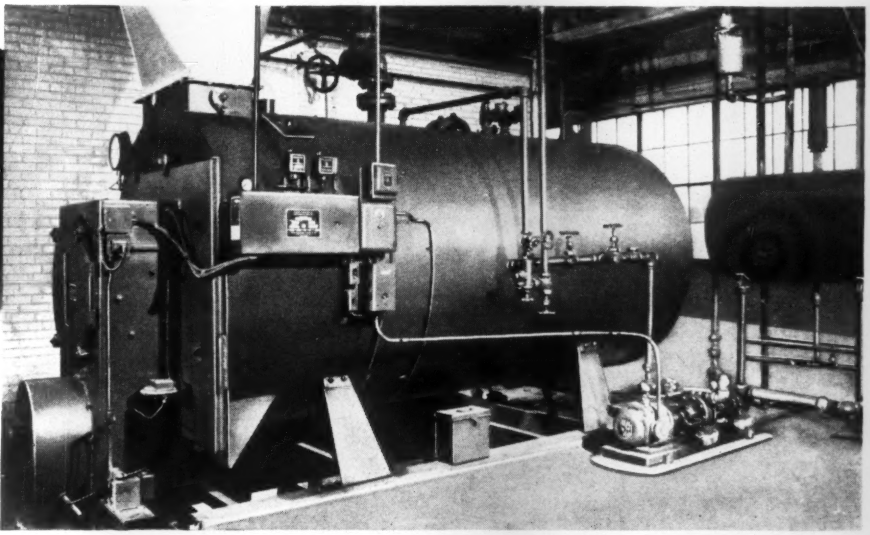
▶ *COMBUSTION CONTROLS, INSTRUMENTS*—Line of automatic controls, instruments for combustion industry described in new catalog. Covers components for complete combustion installation such as: automatic draft control instruments and actuators; solenoid, diaphragm, motor operated valves for oil, gas, steam, water; time switches, relays and oil burner primary controls. *General Controls Co., Dept. HPAC, 801 Allen Ave., Glendale 1, Calif.*

CONDENSING UNITS—Specifications, capacities for open type refrigeration and air conditioning condensing units rated 1/4 to 100 hp presented in data sheet No. 493. In addition, data included for compressor units for use with evaporative condensers rated 1/3 to 100 hp. Also covered are simple compressors in single, two-stage for applications to 100 hp. *Brunner Mfg. Co., Dept. HPAC, 11 Fisher St., Utica, N.Y.*

▶ *CONDUIT* "Therm-O-Tile" conduit for underground piping described in 12 page bulletin. Literature shows how product is constructed, installed. Contains photographs, drawings, dimension tables. Conduit is said to be permanent, economical, simple, efficient. *Porter-Hayden Companies, Dept. HPAC, 825 Frelinghuysen Ave., Newark, N.J.*

▶ *CONTROLS* New catalog lists over 100 items in company's line of automatic controls. Lists controls for single-stage pressure, two-stage pressure, differential pressure, single-stage temperature, two-stage temperature, liquid level, mechanical movement. Also shown are relays, line of mercury switches. *Mercoid Corp., Dept. HPAC, 4201 Belmont Ave., Chicago 41.*

"As an engineer, I know the advantages of SIMPLIFIED OPERATION in Packaged Boilers"



New 150-HP gas-fired Continental Automatic Boiler, installed in Progress Laundry, Dallas, Texas, reducing gas consumption more than one-third. Continental Boiler Distributor: J. P. Philibert, Fort Worth, Texas. Installation by H. C. Lohman Machinery Co., Dallas, Texas.

Six Reasons Why it Pays to Buy a CONTINENTAL Automatic Boiler

- * Guaranteed 80% efficiency . . . Fire-tested before shipment . . . Range, 20 to 500 hp.
- * Simple, practical two-pass design, for uniform flow of combustion gases through all return tubes.
- * Maximum radiant heat transfer achieved by "Spinning Gas" technique for thorough mixing of air and atomized fuel.
- * High-CO_2 and low-temperature stack gases — proof of high combustion efficiency.
- * Free, rapid water circulation improves heat transfer, keeps heating surfaces clean.
- * Easy access to furnace and all return tubes. Refractory baffles and brickwork are not required.

"In designing or modernizing a boiler plant, simplicity of equipment usually means important savings in both labor and fuel. That's just another way of saying it pays to insist on Packaged Boilers.

"Controls are simplified and dependable, and they require practically no maintenance. Cleaning is simplified by easy access to burner and tubes. Air atomizing reduces burner maintenance to a minimum.

"Best of all, the responsibility for this simplified operation rests with one firm only – the manufacturer of the unit. So if we ever do need help, we know exactly where to get it."

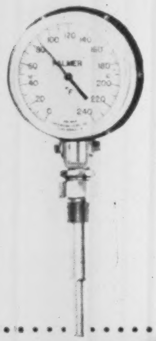
For details on the Continental Automatic Boiler, send for Bulletin BE-3

BOILER ENGINEERING & SUPPLY COMPANY, INC.

8 Manavon Street, Phoenixville, Pa.

A HALF CENTURY OF BOILER MANUFACTURING EXPERIENCE

The Continental AUTOMATIC BOILER

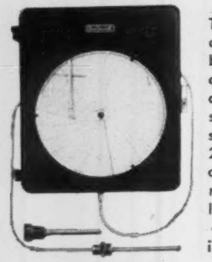


4½" DIAL THERMOMETERS

Made in 3 types to suit any requirements. Rigid stem, wall or flush mounted, 11 inches of scale reading. Interchangeable with standard industrial separable sockets. Stem can be placed at any angle and case can be rotated to any readable position.

PALMER
MERCURY ACTUATED
Temperature Indicating Instruments

RECORDING THERMOMETERS



Twelve inch die-cast aluminum case with black or white wrinkle or satin finish. Single or multiple pen construction. Electric or spring wound clock, 24 hour or 7 Day Revolution. Flexible Armor and bulb of stainless steel. Ranges —40 +950°F or Equivalent in °C.

INDUSTRIAL THERMOMETERS

Red-Reading Mercury —Extruded brass case — chrome finish. Ranges —40 + 950°F or Equivalent in °C.

RED-READING MERCURY LABORATORY THERMOMETERS

Thoroughly annealed for permanent accuracy. Complete line A.S.T.M. and fractional division types.

WRITE FOR CATALOG INFORMATION

PALMER
THERMOMETERS, INC.
Cincinnati 12 Ohio • MElrose 1500

RECENT TRADE LITERATURE

Continued

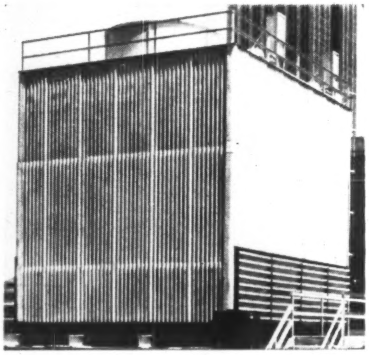
▶ *COOLING CONTROLS*—New 1957 condensed catalog. bulletin 1487-AE, details line of refrigeration and air conditioning controls. Includes listing of standard cooling controls for pressure and temperature applications in standard, heavy duty construction; oil protection controls; water regulating valves; defrost controls; cooling tower controls; solenoid valves; humidistats; cooling and heating-cooling thermostats. *Penn Controls, Inc., Dept. HPAC, Goshen, Ind.*

▶ *COOLING TOWERS*—Induced draft cooling towers for air conditioning and refrigeration service described in 4 page brochure. Included in literature are list of features, illustrations, table of engineering data for company's "Series 3" models. *Fluor Products Co., Div. of Fluor Corp., Ltd., Dept. HPAC, Whittier, Calif.*

▶ *COOLING TOWERS*—"LoLine" cooling towers for air conditioning, industrial service detailed in new 16 page bulletin. Available in two heights, units are said to have low silhouette, high performance, attractive appearance. Literature contains engineering data, dimensional drawings, specification tables for both series. *J. F. Pritchard & Co. of California, Dept. HPAC, 4625 Roanoke Pkwy., Kansas City 12, Mo.*

▶ *DRUM WARMERS, COOLERS*—Form DW-6 contains 2 pages of photographs, dimensions, specifications, prices of line of drum warmers, coolers. Units are heated by steam, hot water, etc. Are said to be safe, simple, economical. *Dean Thermo-Panel Coil Div., Dean Products, Inc., Dept. HPAC, 616 Franklin Ave., Brooklyn 38.*

▶ *DUST CONTROL*—Dust control in manufacture, processing, handling of building materials covered in bulletin 554-D. Literature is made up of four illustrated case histories

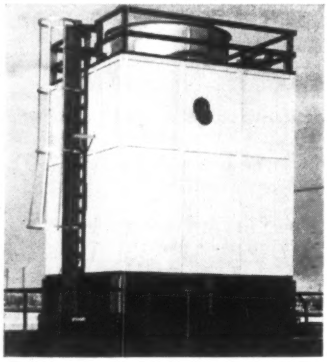


The Phillips Transite Cooling Towers have been in operation over nine years and proven to furnish the required cooling with lowest possible maintenance cost. Phillips Towers are available with framing of California Redwood or Hot Dipped Galvanized Steel as preferred.

The new Phillips nailless fill adds to simplicity of erection and maintenance.

The Phillips eliminator system guarantees minimum drift loss.

When you have a cooling problem call your Phillips representative.



Phillips
Cooling Tower Co., Inc.
220 DUPONT ST., BROOKLYN 22, N. Y.

when buying
copper or
copper base
alloy tubing
remember

TEMPER

it should
be tuned
to the task!

The right temper for the task can mean the difference between success or failure, profit or loss. But, relax! Whatever your requirements, specify United seamless copper or copper base alloy tubing. Do so with confidence that the industry's finest quality and production control systems will deliver tubing drawn precisely to your specifications . . . for temper, size, gauge, grain structure, cleanliness, dimensional perfection and cost!

You pay no more for this quality! United tubing, the finest in copper and copper base alloy, is available in coils, straight mill lengths or cut to your specifications.

For full information, write or call United.

Permanently United

UNITED WIRE
AND SUPPLY CORPORATION
PROVIDENCE 7, RHODE ISLAND

COPPER, BRASS, ALUMINUM WIRE AND TUBE . . . BRAZING ALLOYS • PHOSON • SIL-BOND

VISIT BOOTH 305, AWS WELDING SHOW, APRIL 9–11, 1957, CONVENTION HALL, PHILADELPHIA, PA.

ATTENTION DETROIT!

Detroiter runs Mr. Entropy* through— stops steam waste with SELECTOTHERM

Around Detroit, Coon DeVisser, 2051 W. Lafayette Blvd., is a well-known "executioner" of steam waste in schools and other buildings where boilers are used for steam heating.

He does it with SELECTOTHERM, the high-vacuum heating system that automatically provides steam at the proper pressure and temperature for perfect comfort. Installation records show that SELECTOTHERM cuts the fuel bill 19% or more—*enough to pay for the system within five years!*

SELECTOTHERM applies the control directly to the boiler, adds to the effectiveness of unit ventilators and individual room control. Get the whole story. If you're from the Detroit area, call the Coon DeVisser Co. (Tashmoo 5-6000). If not, write for fact-filled SELECTOTHERM booklet, *Boiler Room Ballad.*

* *Mr. Entropy represents the heat that is produced but unavailable for use.*

SELECTOTHERM
HEATING CONTROL SYSTEM

A product of Illinois Engineering Co.
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RECENT TRADE LITERATURE

Continued

showing how company's cloth-filter-type dust collectors are employed. Performance data given. *Wheelabrator Corp. Dept. HPAC, 1321 S. Byrkit St., Mishawaka, Ind.*

▶ *ELECTRIC MOTORS*—New 12 page application guide is designed to make motor selection easy. Tables provide data on line of electric motors 1/20 to 400 hp. in polyphase, single phase, d-c types. *Century Electric Co., Dept. HPAC, 1806 Pine St., St. Louis 3.*

▶ *ENGINEERING TABLES, DATA*—First supplement to booklet, *Selected Scientific and Engineering Tables and Data*, available from company. Contains additional charts, tables not included in earlier publication. *United States Testing Co., Inc., Dept. HPAC, 1115 Park Ave., Hoboken, N.J.*

▶ *FUME COLLECTING*—Bulletin 553-D discusses prevention of atmospheric pollution caused by fume from electric steel melting furnaces. Includes general discussion of cloth filtration for cleaning electric furnace ventilation air, nine photographs of actual installations showing the effect. *Wheelabrator Corp., Dept. HPAC, 1321 S. Byrkit St., Mishawaka, Ind.*

▶ *HORIZONTAL PRESSURE FILTERS*—Publication 6322 furnishes details on line of horizontal pressure filters. Units recommended by company for use in industrial plants, other types of institutional and commercial applications. Literature describes operation, control, filter bed materials, design features, available accessories. *Cochrane Corp., Dept. HPAC, 17th St. below Allegheny Ave., Philadelphia 32.*

▶ *HOSE, FITTINGS*—Catalog 4431 details re-usable "Hoze-lok" fittings used with cotton covered single wire braid hose for fluorinated hydrocar-

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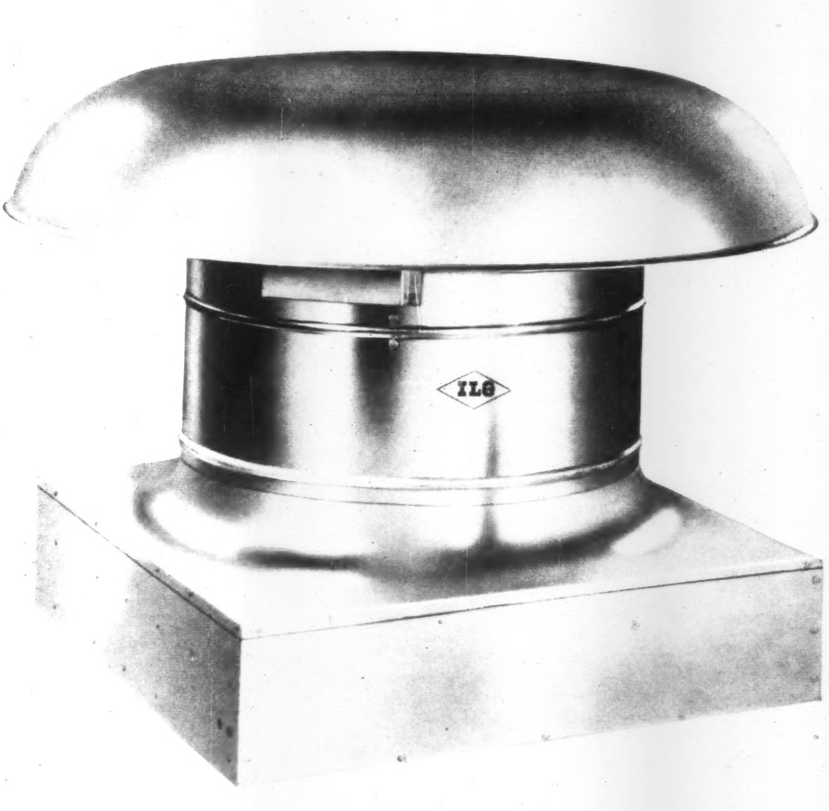

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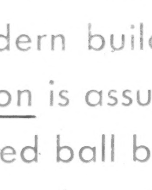

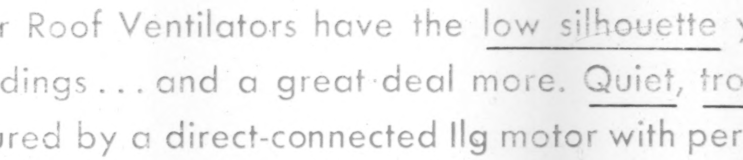

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bon refrigerant No. 12 service. Fittings offered with male pipe threads, 45 deg or "Triple-lok" 37 deg flare hose or swivel nut. *Tube & Hose Fittings Div., Parker Appliance Co., Dept. HPAC, 17325 Euclid Ave., Cleveland 12.*

▶ *INDIRECT EVAPORATIVE COOLING SYSTEMS*—Four page booklet describes indirect evaporative cooling systems such as simple dry surface cooling system, indirect-direct cooling system, multistage cooling system, regenerative dry surface cooling system, plate type heat exchanger system, combination of evaporative cooling with refrigeration or heating. *Holmes & Narver, Inc., Dept. HPAC, 828 S. Figueroa St., Los Angeles 17.*

▶ *INDUSTRIAL GAS CHROMATOGRAPH*—Specification sheet 800 details industrial gas chromatograph "Model 220." Discussed are temperature control, sampling system, column construction, carrier gas analysis record, accuracy, speed of analysis. *Beckman Instruments, Inc., Dept. HPAC, 2500 Fullerton Rd., Fullerton, Calif.*

▶ *INDUSTRIAL INSULATIONS*—Specifications for line of spun mineral wool industrial insulating products presented in 20 page catalog. Literature lists standard sizes, thicknesses, thermal conductivities for more than 20 types of heat and cold insulations for equipment and piping. Also includes temperature-thickness recommendations for each. *Baldwin-Hill Co., Dept. HPAC, 500 Breunig Ave., Trenton 2, N.J.*

▶ *LIQUID RETURN SYSTEMS*—Bulletin LRS-56, 6 pages, covers liquid return systems for ammonia. Systems are designed to protect compressors, increase refrigeration efficiency, simplify defrosting and maintenance. Literature contains photographs, drawings, tables of specifications. *H. A. Phillips & Co.,*

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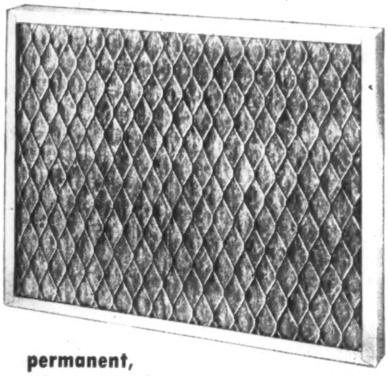

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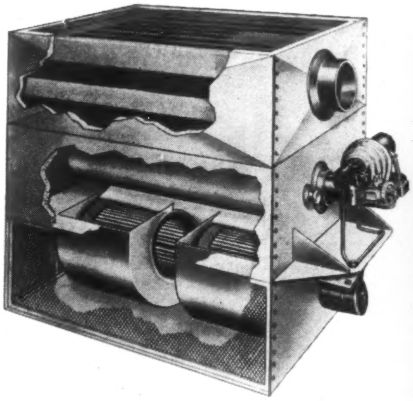

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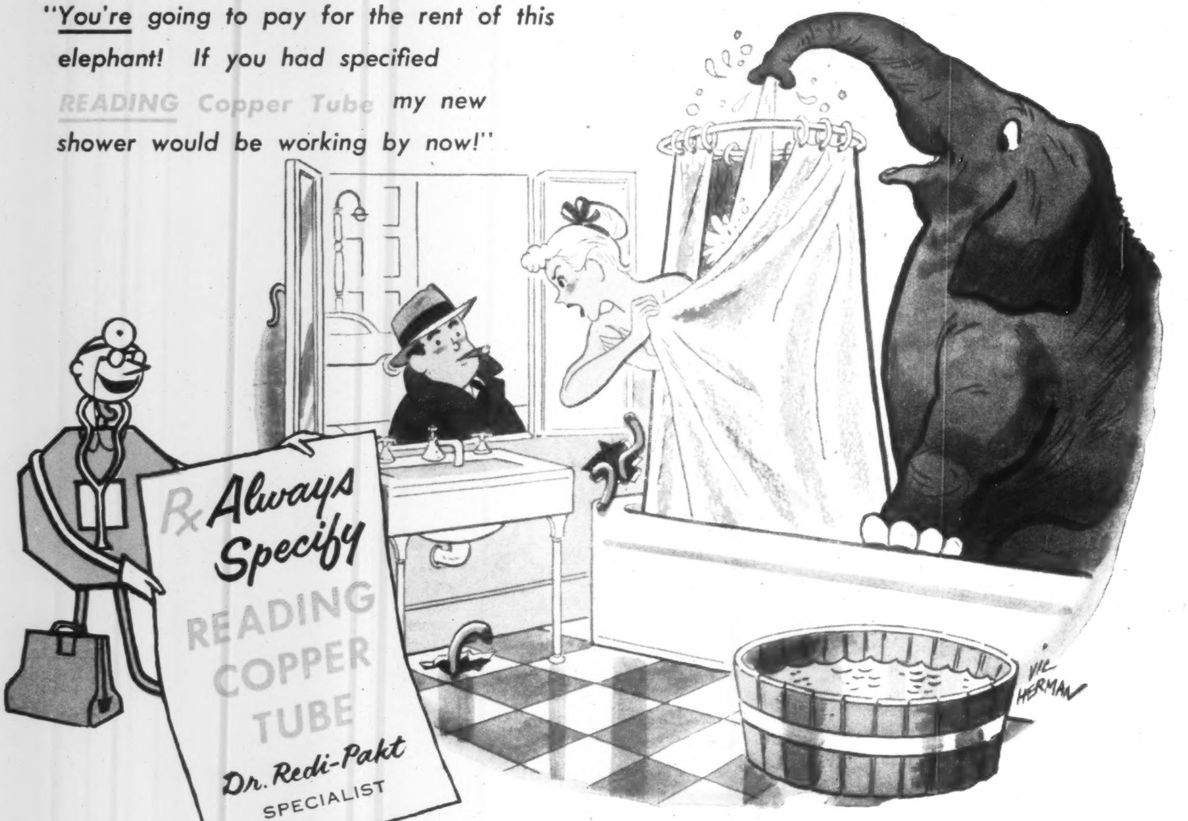

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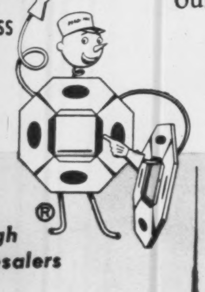

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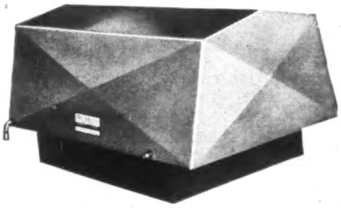

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Dept. HPAC, 3225 W. Carroll Ave., Chicago 24.

▶ *PACKAGED AIR CONDITIONERS*—Bulletin 218, 2 pages, covers company's line of 3, 5, 8 ton packaged air conditioning units. Provides table of specifications, ratings. Cites ease, speed with which units may be installed, as well as economy of operation. *Typhoon Air Conditioning Co., Inc., Div. of Hupp Corp., Dept. HPAC, 505 Carroll Ave., Brooklyn 15.*

▶ *PLASTIC PIPE*—Service provided by pipe made of "Bakelite" polyethylene described in new brochure. Literature outlines specifications for safe working pressures of standard wall pipe, adopted by pipe industry. *Bakelite Co., Div. of Union Carbide and Carbon Corp., Dept. HPAC, 30 E. 42nd St., New York 17.*

▶ *PORTABLE TOOLS*—1957 catalog contains 50 pages illustrating, describing portable tools for manufacturing, construction, metalworking industries. *Skil Corp., Dept. HPAC, 5033 Elston Ave., Chicago 30.*

▶ *POWER ROOF VENTILATORS*—New 8 page bulletin 3904 describes redesigned line of power roof ventilators. Covers construction, operation, design features of each of four models. Installation drawings provided. Dimensions given in tabular form. *American Blower Corp., Dept. HPAC, Detroit 32.*

▶ *PUMP UNITS*—New 8 page catalog No. 107 contains information on line of "SU" pump units, designed principally for handling heavy fuel oils in industrial, commercial oil burner service. Charts, diagrams provide dimensions, operating characteristics, pump and motor performance data. *Tuthill Pump Co., Dept. HPAC, 939 E. 95th St., Chicago 19.*

▶ *PUMPS*—Folder No. 327 covers operating characteristics, applications

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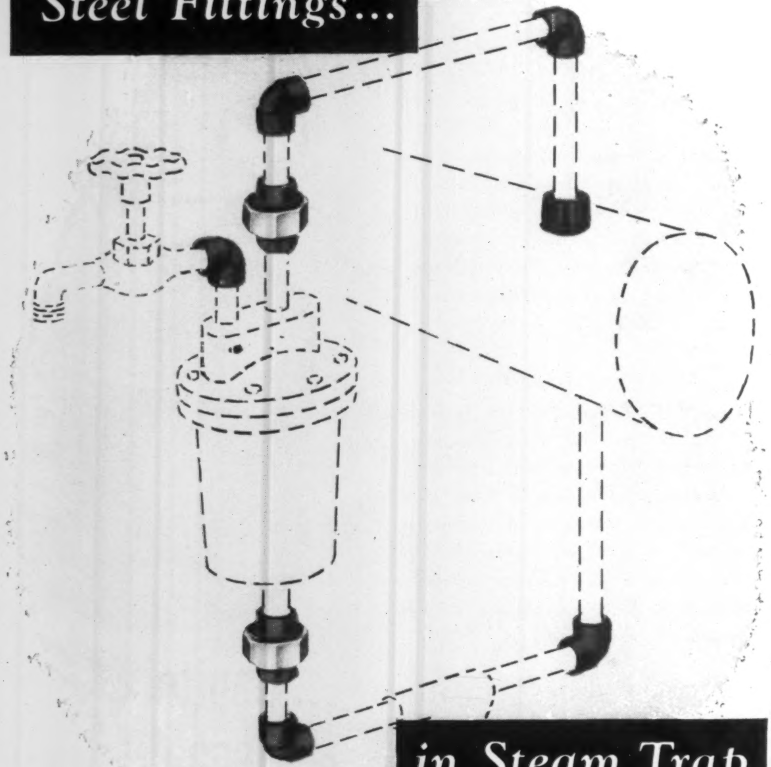

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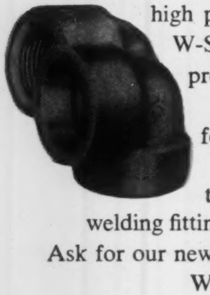

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for company's "Porta-Pump" line. Includes specifications, performance chart. Units recommended by company for range of construction, industrial uses. *Barnes Mfg. Co., Dept. HPAC, Mansfield, Ohio.*

▶ *PUMPS*—"Verti-Line" close coupled industrial pumps detailed in 12 page bulletin 1100. Literature includes table for determining horsepower, capacity, head for vertical pumps. Also contains sectional views, material specifications, schematic application drawings, photographs of installations. *Layne & Bowler Pump Co., Dept. HPAC, 2943 S. Vail Ave., Los Angeles 22.*

▶ *REGISTERS, GRILLES*—Describing company's line of registers and grilles, catalog 76-C is illustrated with products, accessories, engineering data. Also listed is return air grille with new and improved curved blade design, says company. *Carnes Corp., Dept. HPAC, Verona, Wis.*

▶ *RESIN*—"Nafil" resin for making polyurethane foam covered in 6 page folder. Product is said to foam, set and cure at room temperatures. Is recommended by company for such uses as acoustical treatment, thermal insulation, sound deadening. *Chase Chemical Corp., Dept. HPAC, 3527 Smallman St., Pittsburgh 1.*

▶ *ROOM AIR CONDITIONERS*—New 42 page booklet contains facts about company's line of room air conditioners. Sketches, written descriptions outline functions of each component part, show its location, demonstrate its importance to unit as a whole. *Mitchell Mfg. Co., Div. of Cory Corp., Dept. HPAC, 3200 W. Peterson Ave., Chicago.*

▶ *SHEET METAL WORKING MACHINES*—New 20 page booklet No. 202 summarizes data on power operated machines for light sheet metal

(*Continued on page 256*)

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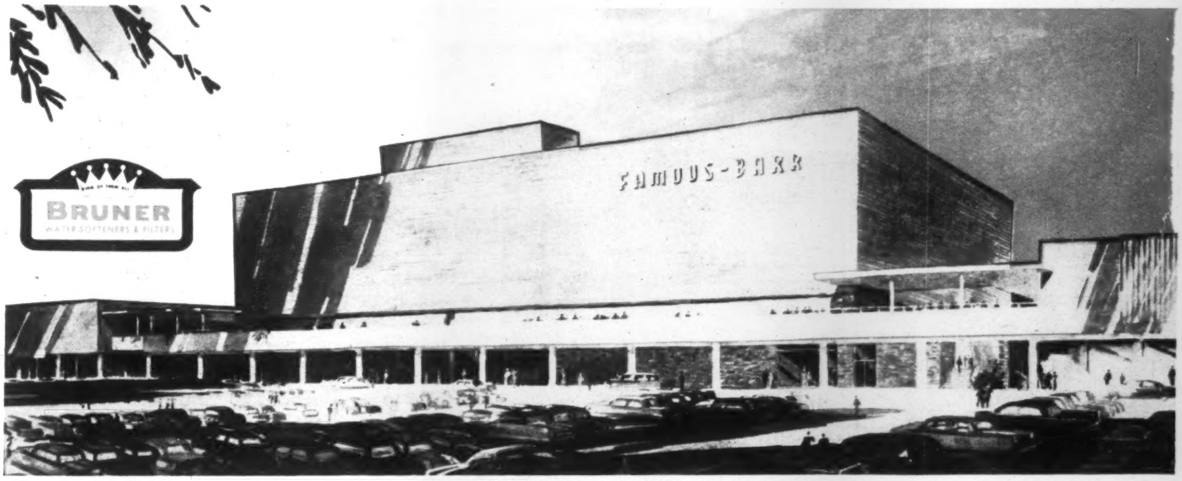
INDUSTRIAL WATER SOFTENERS



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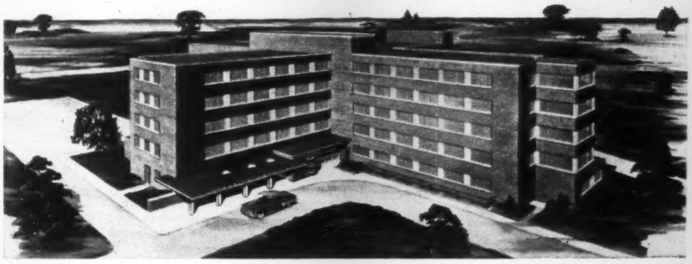

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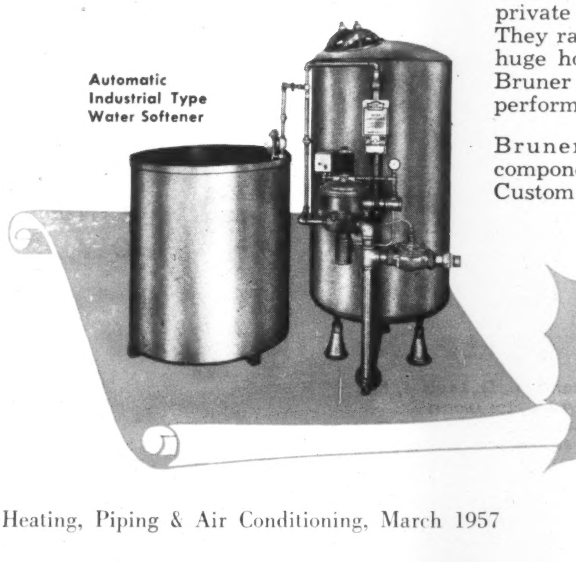

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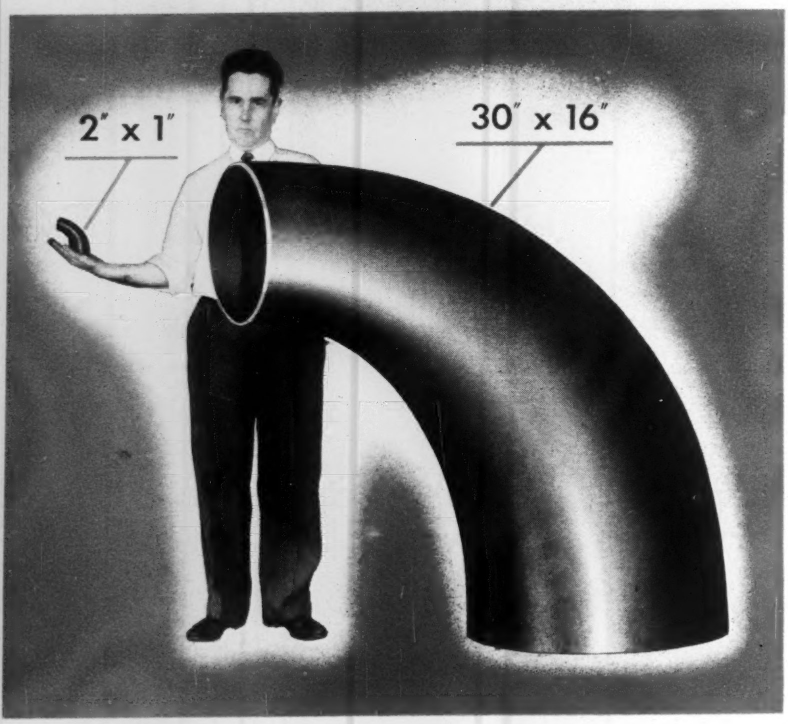

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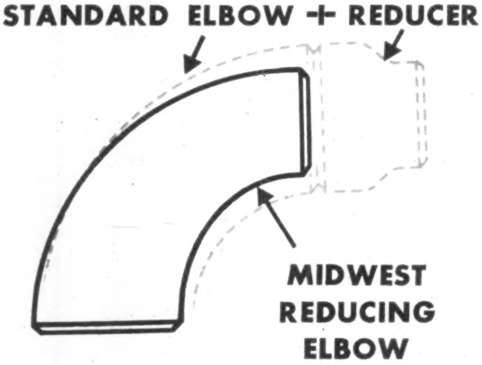

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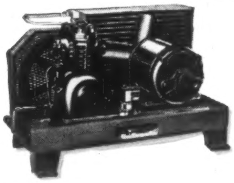

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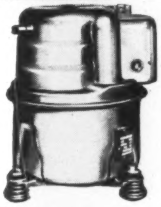

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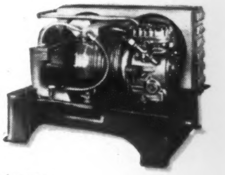

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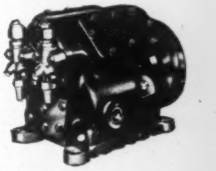

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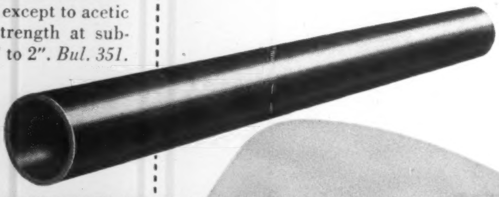

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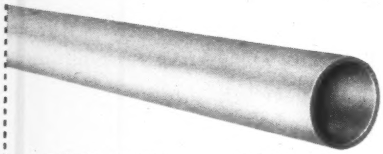

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RECENT TRADE LITERATURE

Continued from page 252

work. For more complete literature on individual machines or lines, references are made to specific bulletins available from company. *Niagara Machine & Tool Works, Dept. HPAC, 683 Northland Ave., Buffalo.*

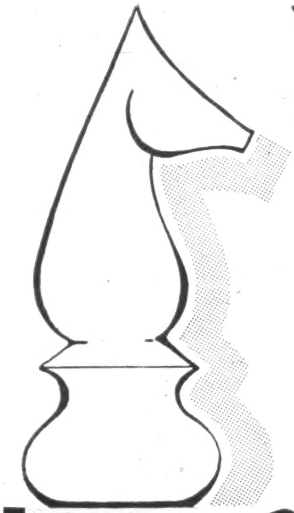
▶ *SHEET METAL WORKING MACHINES, TOOLS*—New 32 page booklet 201 catalogs briefly company's line of manually operated machines, tools for light sheet metal work. Contains summarized data, descriptions of important models. *Niagara Machine & Tool Works, Dept. HPAC, 683 Northland Ave., Buffalo.*

▶ *SPRAY TYPE DESUPERHEATER*—Design, installation, typical application of spray type steam desuperheater, designed to have high capacity and be fast-acting, described in 4 page bulletin M55-1. Dimensions provided, together with ordering information. *Bailey Meter Co., Dept. HPAC, 1050 Ivanhoe Rd., Cleveland* 10.

▶ *SQUARING SHEARS*—Underdrive power squaring shears detailed in 74 page bulletin No. 69G. Features described, illustrated. Shearing capacities range 16 gage to 1 in. mild steel and cutting lengths 4 to 20 ft. *Niagara Machine & Tool Works, Dept. HPAC, 683 Northland Ave., Buffalo* 11.

▶ *STAINLESS STEEL FASTENERS*—Twelve page catalog covers stainless steel "AN" fasteners. Includes illustrations, stock sizes, principal dimensions, explanation of part and dash numbers for each item. *All-metal Screw Products Co., Inc., Dept. HPAC, 821 Stewart Ave., Garden City, L.I., N.Y.*

▶ *STAINLESS STEELS*—Eight page booklet contains information on types 308, 309, 310 stainless steels, including such data as physical properties, heat treatment, strength at elevated temperatures, fatigue strength, resistance to oxidation. *Allegheny*



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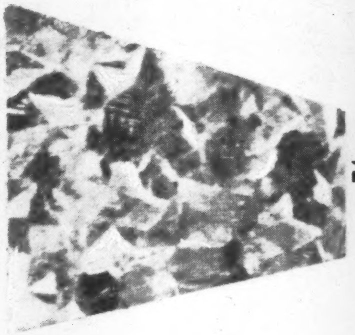
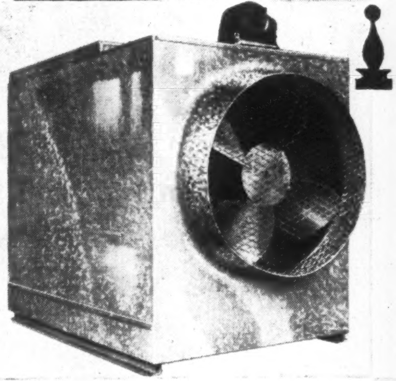
in packaged cooling towers... DOVER

America's New Standard For Packaged Cooling Towers



HOT-DIP GALVANIZING AFTER FABRICATION

. . . effectively stops rust with a heavy zinc coating that leaves no gaps or unprotected spots. You pay nothing extra for the superior protection of hot-dip galvanizing AFTER fabrication.

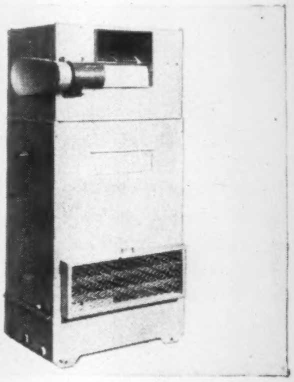


HORIZONTAL INDUCED DRAFT TOWER Series CF

Ruggedly built for efficient operation, it is available in sizes from 2 to 100 tons. The perfect unit for air conditioning and refrigeration installations and for jacket water or compressor cooling.

VERTICAL INDUCED DRAFT TOWER Series V

Has centrifugal blower and is extra quiet in operation. Perfect for installations where space is a problem, it's available in sizes from 5 to 100 tons.

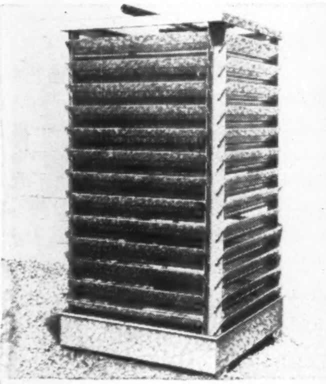


STAINLESS STEEL FANS

All horizontal induced draft towers—Series CF—are equipped with a propeller fan and shaft made of stainless steel. A distinctive Dover feature that insures long life and dependable service.

"TAKE-APART" FEATURE

Unique tie-rod construction, virtually eliminating bolts, enables Dover towers to be quickly disassembled and put together again right on the job site. Difficult locations no longer a problem.

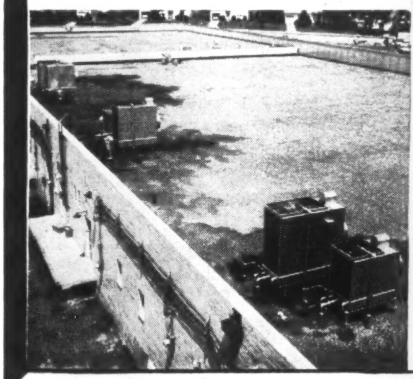


Series K—All steel
Series S—Steel and Redwood

NATURAL DRAFT TOWERS

Both series have famous Dover bolt-free construction, and are available from 2 to 225 tons. Series K meets all municipal fire codes. Series S has steel basins and crowns with redwood louvers and posts; features lower price.

Make your next move now! Send for your free Dover Catalog, displaying their complete line of packaged towers. Act now!



Construction engineers, building the smart, new Mission, Kansas shopping center specified Dover packaged towers. 18 units, ranging from 3 to 100 tons, are now operating efficiently and economically for all the tenants.

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Dept. 100, 3117 Weatherford Ave.
Independence, Missouri

☐ **Please send me a free copy of the new Dover Catalog.**

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FIRM____________________

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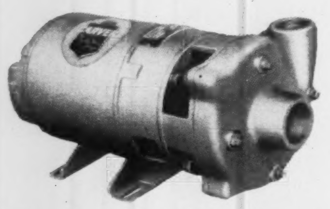
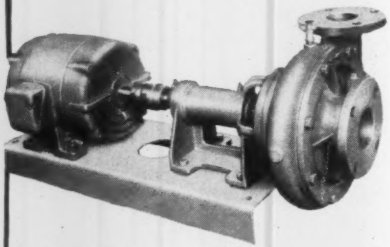
CITY__________ZONE_____STATE_____

CARVER MODEL B PUMPS

. . . the Air Conditioning Pumps primed with Extra Values . . . your best buy for Cooling Towers, Chill Water Circulation and Hot Water Heating Systems.



Choose from CARVER'S complete line of reliable, versatile pumping units that feature Quiet, Vibration-Free Operation, Maximum Performance, Efficiency and Economy.



Carver *close-coupled* Electro-pumps as well as Carver *base-mounted* Pumps are available in all sizes with capacities up to 1000 G.P.M. and heads up to 240 feet.

Excellent as original equipment. Modern in design, pleasing in appearance, they add the final touch to fine equipment.

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1460 Hershey Ave.
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CARVER
CARVER
the quality name in pumps

RECENT TRADE LITERATURE

Continued

Ludlum Steel Corp., Dept. HPAC, 2020 Oliver Bldg., Pittsburgh 22.

▶ *STEAM COILS*—Bulletin S-200 describes company's new line of standard and "nonfreeze" steam coils, using its "Turbo-Flo" finned surface for high heat transfer. Describes construction of coils, including tubing, casings, headers, refrigerant distribution, return bends, valves. *Halstead & Mitchell, Dept. HPAC, 704 Bessemer Bldg., Pittsburgh 22.*

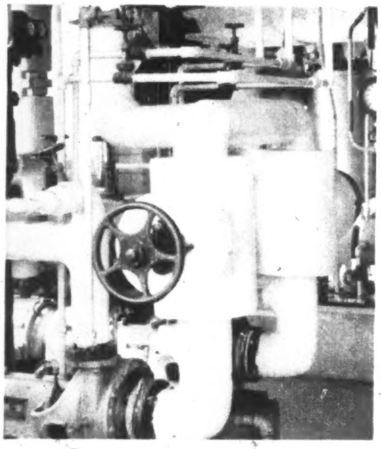
▶ *SYSTEM LOAD, FREQUENCY CONTROL*—Bulletin B91-1 describes all-electronic load and frequency control systems for captive plant, small utilities, multiple station systems. Covers individual servos that form interlocking, continuous chain for cumulative control of all factors. *Minneapolis-Honeywell Regulator Co., Industrial Div., Dept. HPAC, Wayne and Windrim Aves., Philadelphia 44.*

▶ *"TEFLON" LINED PIPE*—New 2 page bulletin T-100 details application of "Teflon" as liner for schedule 80 steel pipe. Assembly is said to solve corrosion problems in chemical, petroleum, pharmaceutical, food processing, other industries. Literature includes drawings, table of specifications. *Haveg Industries, Inc., Dept. HPAC, 900 Greenbank Rd., Wilmington 8, Del.*

▶ *TITANIUM*—Among subjects covered in "Titanium Buyer's Guide" are: how titanium is made, grade nomenclature, specifications, sponge, powder, sheet, strip, plate, bar, discs and rings, wire, extruded shapes, weight tables. *Titanium Metals Corp. of America, Dept. HPAC, 233 Broadway, New York 7.*

▶ *TUBE FITTINGS*—"O-ring" tube fittings, designed to eliminate flaring, threading, welding, soldering, covered in 4 page bulletin. Contains il-

Swift's LAGGING ADHESIVES



the *Improved* Way to Adhere Insulation to Piping

For bonding insulation to piping or adhering lagging cloth to insulation, Swift's Improved Lagging Adhesives give you twelve important advantages—

1. EASY TO USE
2. FAST SETTING
3. NON-HAZARDOUS
4. FLAME-RESISTANT FILM
5. MOISTURE RESISTANT
6. MOLD RESISTANT
7. GOOD UNDERCOATING FOR PAINT
8. ADHESIVE PROPERTIES
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10. SAVES PAINT
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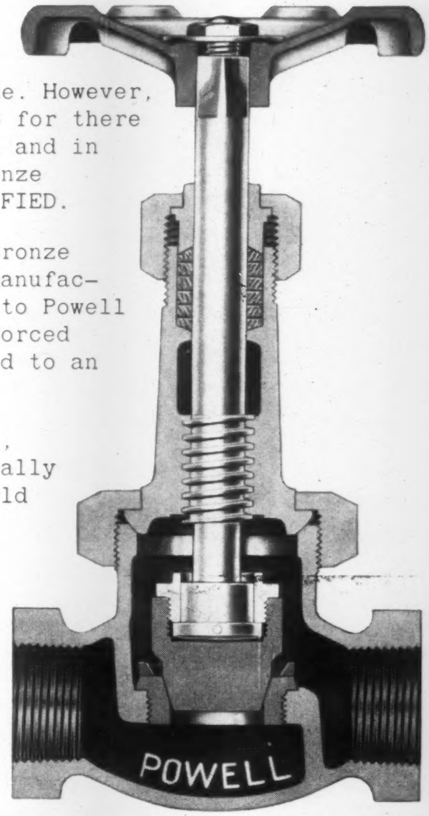
12. MEETS ACCEPTED SPECIFICATIONS

The only sure way to find out what these advantages can mean to you is by a trial order. You can get a trial size supply at the quantity price. Write for details. SWIFT & COMPANY, Adhesive Products Department, 4115 Packers Ave., Chicago 9, Ill.

Swift
102ND YEAR

To Serve Your Industry Better

Inside Story on POWELL BRONZE VALVES



Bronze Valves may be look-a-likes on the outside. However, their performance may be quite another story -- for there can be a big difference in the metal, in design and in manufacture. And the inside story on Powell Bronze Valves is that every valve has PERFORMANCE VERIFIED.

The reason there's a big difference in Powell Bronze Valves is quality control. It begins not with manufacture -- but with the very materials which go into Powell Valves. As a final step of Powell's rigidly enforced quality control, every Powell Valve is subjected to an actual line test.

Because of Powell's painstaking quality control, plant shutdown through valve failure is practically unknown. Records from industrial plants the world over prove it.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our COMPLETE quality line which has PERFORMANCE VERIFIED.

FIG. 2608 -- (Sectional) Bronze "WS" Full Flow Globe Valve for 200 pounds W. P.

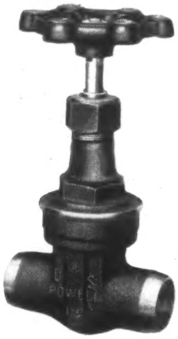


FIG. 1821 -- Bronze Gate Valve for 125 pounds W.S.P. Inside Screw Rising Stem.

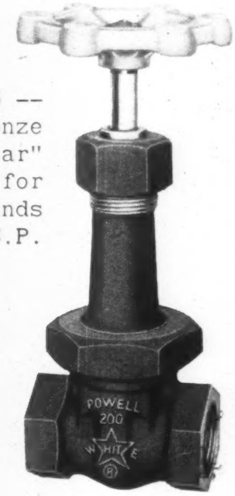


FIG. 375 -- Bronze "White Star" Gate Valve for 200 pounds W.S.P.

PERFORMANCE
PV
VERIFIED

The Wm. Powell Company, Cincinnati 22, Ohio . . . 111th YEAR

POWELL VALVES

BRONZE, IRON, STEEL AND CORROSION RESISTANT VALVES

MANNING & LEWIS ENGINEERING CO.
28-42 OGDEN ST. NEWARK 4, N.J.
WORKING PRESS:- SHELL
TUBES
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FUEL OIL HEATERS WATER HEATERS and COOLERS

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WHERE DEPENDABILITY IS A MUST ! !

When the Alexian Brothers Hospital in Elizabeth, N. J. developed a fuel oil preheating problem, Manning and Lewis were consulted as specialists in this field. The illustrated unit was designed and fabricated to meet all necessary requirements. For years it has delivered, and continues to deliver the type of perfect service demanded of heating systems in modern hospitals — efficient, economical and completely dependable.

Manning & Lewis *Engineering Company*
DESIGNERS & MANUFACTURERS OF QUALITY HEAT EXCHANGE EQUIPMENT
28-42 OGDEN STREET NEWARK 4, NEW JERSEY
M.L

Prevent **PILOT FAILURE**

with a flu-bonnet

Attractive AND Functional
Stops Backdraft AND Excess Draft
(Amazing pressure-balancing design patented)
Keeps heat inside AND Saves fuel

TESCO *Incorporated*
1403 East 5th Court
TULSA, OKLAHOMA

RECENT TRADE LITERATURE

Continued

lustration, table of specifications for each unit in line. Also presents other of company's products including outside deburring cutters with detachable handle, tube cutters, hand tube benders. *Lenz Co., Dept. HPAC, 3301 Klepinger Rd., Dayton 1, Ohio.*

▶ *TUBING CUTTER, FLARING TOOL*—Literature briefly describes tubing cutter designed to cut $\frac{1}{8}$ to 1 in. tubing; flaring tool for 3/16, $\frac{1}{4}$, 5/16, $\frac{3}{8}$, 7/16, $\frac{1}{2}$, $\frac{5}{8}$ in. OD copper, aluminum or brass tubing. *Erie Tool Works, Dept. HPAC, Erie, Pa.*

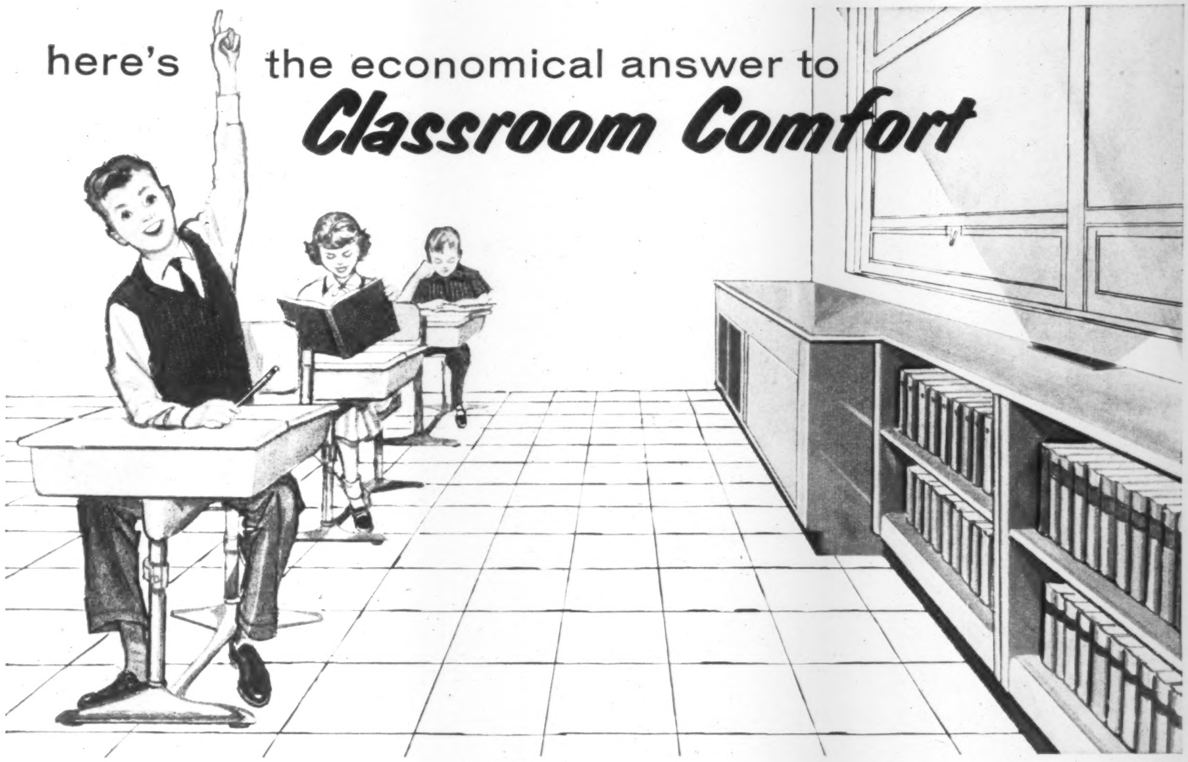
▶ *VALVE WARMERS, COOLERS*—"Thermo-Panel" coil valve warmer described in form V-2. Recommended by company for steam, other heating. Also for cooling. *Dean Thermo-Panel Coil Div., Dean Products, Inc., Dept. HPAC, 616 Franklin Ave., Brooklyn 38.*

▶ *VALVES*—Forged steel gate and needle valves designed for petrochemical, power, process industries described in 12 page bulletin DH-80. Literature lists material specifications, pressure-temperature ratings, working pressures, dimensions, applications. *R-P&C Valve Div., American Chain & Cable Co., Inc., Dept. HPAC, Reading, Pa.*

▶ *VENTILATING UNITS*—Catalog on self contained ventilating blower units describes features, performance of "Vent-All" units. Contains 24 pages of technical data, information as well as additional data relating to ventilating with packaged blower models. *Master Fan Corp., Dept. HPAC, 1323 Channing St., Los Angeles* 21.

▶ *VENTILATORS, RANGE HOODS*—New 4 page catalog shows line of 1957 "Kitchen-Aire" ventilators and range hoods for commercial kitchens. Also, introduces fan-in-hood combination. *Stewart Industries, Inc.,*

here's the economical answer to *Classroom Comfort*



Norman Gas-Fired Schoolroom Heating and Ventilating System

In one complete package for the individual classroom, Norman engineers have designed everything needed to assure economical and healthful classroom comfort — automatically.

And, because the Norman gas-fired, forced air heating and ventilating system is specifically designed for modern schools, it offers important advantages for new school construction and expansion programs. No separate building or extra space is needed for a central heating plant. Simplifies expansion programs — just add another Norman unit for each additional classroom.

NORMAN COMPLETE PACKAGE PROVIDES:

- Perimeter forced air distribution at proper angles for constant classroom comfort without draft or stale air pockets.
- Automatic operation cycles which include warm-up, daytime or occupied period, and nighttime period.
- Automatic ventilation with proper mixture of outdoor air and room air.

NORMAN COMPLETE PACKAGE INCLUDES:

- Automatic gas-fired, forced air central heating furnace and enclosure, pre-wired and fire-tested at factory.
- Standard length Util-i-Duct sections of sturdy furniture gauge steel, shipped ready to install. Each section includes quality adjustable perimeter diffuser . . . aluminum trim for front top edge . . . resilient gasket for back top edge. (Filler and corner sections available.)
- Electrically controlled multi-blade air damper assembly for automatic inside and outside air modulation.
- Rugged aluminum outside weather grilles and mounting frames for fresh air and combustion air openings.
- Automatic controls for complete modulation of heating and ventilation air requirements.

OUTSIDE AIR ONLY USED FOR COMBUSTION

Mail the coupon today for complete details and specifications.

Norman®
products company

NORMAN PRODUCTS CO.
1156 Chesapeake Ave., Columbus 12, Ohio

Please send complete information and specifications on the Norman Gas-Fired Schoolroom Heating and Ventilating Package.

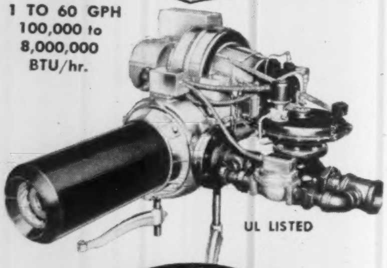
NAME____________________

FIRM NAME____________________

ADDRESS____________________

CITY__________ STATE__________

DUAL FUEL SITUATIONS NEED EXTRA THOUGHT



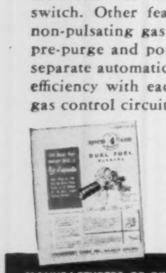
GAS
syncro flame
OIL

OIL/GAS BURNERS HAVE EXTRA FEATURES FOR SURER SUCCESS

In those situations where you can take advantage of off-peak gas rates, it is often possible to reduce heating costs substantially. The SYNCRO/FLAME Dual Fuel Burner is designed *especially for such circumstances.* Various distinctive features have been incorporated, to provide *outstanding performance.* One of these is . . .

AUTOMATIC CHANGE-OVER

. . . which can be accomplished by outdoor thermostat or any other suitable sensing switch. Other features include a positively non-pulsating gas flame, graduated light-off, pre-purge and post-purge on larger models, separate automatic adjustments for maximum efficiency with each fuel, and explosion-free gas control circuitry.



FREE LITERATURE

Write today for descriptive circulars describing all features, and giving full specifications on wide range of sizes available. Ask for Catalog 551.

MANUFACTURERS OF OIL AND GAS AND OIL/GAS BURNERS
SYNCHRONOUS FLAME, INC.
WALWORTH • WISCONSIN

RECENT TRADE LITERATURE

Continued

Dept. HPAC, 320 E. St. Joseph St., Indianapolis 2.

▶ *VIBRATION ELIMINATORS*—Literature describes vibration eliminators available with majority of company's lines of air conditioning, refrigeration equipment. Charts indicate total number of eliminators required per unit, shipping weights, and include diagrammatic cross-sections of these components. *Drayer-Hanson, Div. of National-U.S. Radiator Corp., Dept. HPAC, 3301 Medford St., Los Angeles 63.*

▶ *WATER DEFROST CEILING COILS*—Catalog 2C6a details features of water defrost ceiling coils. Added to literature is dimensional and specification data on 5 ton ammonia ceiling coil. Other information includes data on sizes of accumulators for use with flooded ammonia ceiling units; dimensional changes showing pitched drain pan now used on all of company's units; changes in heat exchanger dimensions. *Recold Corp., Dept. HPAC, 7250 E. Slauson Ave., Los Angeles 22.*

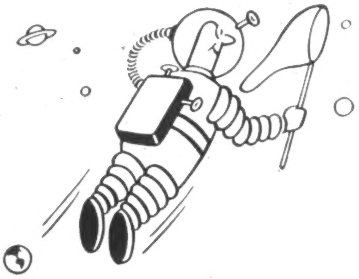
▶ *WATER TREATMENT*—*Automation of Boiler Feedwater and Process Water Treatment Plants* is title of technical reprint T-148. Several case histories present problems encountered and methods of solution. In addition to illustrations, article presents chart of various types of demineralizers available, their application and advantages. *Graver Water Conditioning Co., Dept. HPAC, 216 W. 14th St., New York 11.* ⌗

DON'T FORGET EASTER SEALS

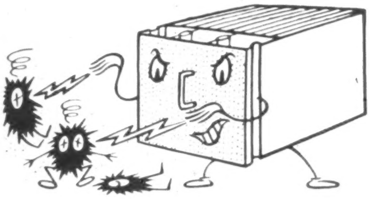
National Society
for
Crippled Children and Adults
11 So. LaSalle Chicago 3

AIR-MAZING FACTS

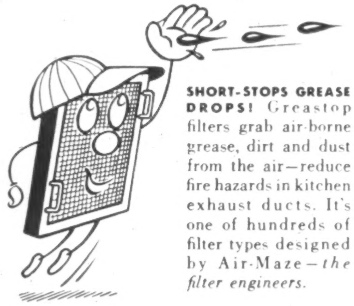
BY O. SOGLOW



CLEAN AIR IS OUT OF THIS WORLD! To find atmosphere completely free from earth-formed dirt, you'd have to travel 60 miles—straight up! But there's an easy, down-to-earth way of getting super-clean air.



ELECTROCUTES DUST! For industrial or commercial applications the Electromaze electronic air filter uses an electrical charge to remove the finest dusts, pollens—even smoke particles. Widely used in ventilating offices, hospitals, and stores. Can be serviced automatically. New G-E selenium rectifier eliminates tube maintenance.



SHORT-STOPS GREASE DROPS! Greastop filters grab air-borne grease, dirt and dust from the air—reduce fire hazards in kitchen exhaust ducts. It's one of hundreds of filter types designed by Air-Maze—*the filter engineers.*

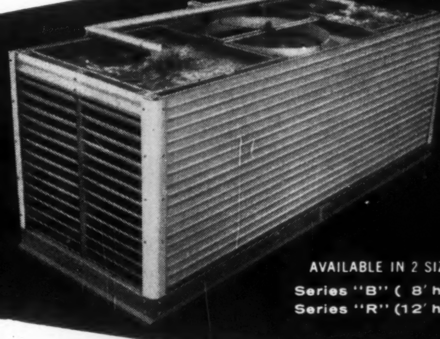
FOR AIR CONDITIONING AND VENTILATING EQUIPMENT, ENGINES, COMPRESSORS *or any device using air or liquids*—there is an Air-Maze filter engineered to solve each filtering problem. For new all-line catalog, write Air-Maze Corporation, Dept. D-1, Cleveland 28, O.

AIR-MAZE
The Filter Engineers
AIR FILTERS • SPARK ARRESTORS • LIQUID FILTERS
SILENCERS • OIL SEPARATORS • GREASE FILTERS

THESE

PRITCHARD

LOLINE®



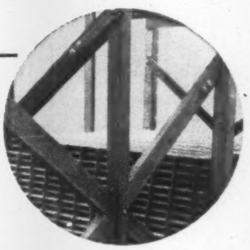
AVAILABLE IN 2 SIZES
Series "B" (8' high)
Series "R" (12' high)

FEATURES

Give You More for Your Cooling Tower Dollar!

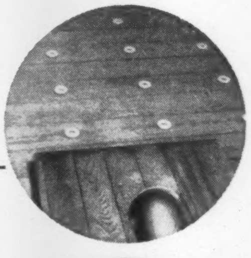
ALL HEART REDWOOD FRAMEWORK

Here is framework designed to withstand windloads of 100 mph (30 lbs./sq. ft.). The same heavy cast iron connectors used in the largest Pritchard industrial towers are used throughout. This rugged framework is built to last and last.



FUNCTIONAL, ATTRACTIVE EXTERIOR

The corrugated asbestos cement board casing used on the LoLine has horizontal corrugations which further enhance the low silhouette of both the Series "B" (8' high) and the Series "R" (12' high) tower. Casing is securely bolted to the framework and corners are covered with asbestos cement corner rolls.

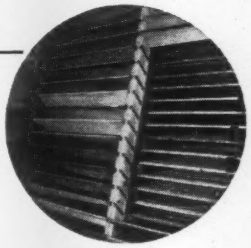


TROUBLE-FREE DISTRIBUTION SYSTEM

This open distribution system results in low pumping head requirements. Removable ceramic orifices distribute water uniformly over the Redwood filling.

SIMPLE, RUGGED FILLING AND DRIFT ELIMINATORS

Only Clear All Heart Grade Redwood is used in the nailless filling of the LoLine. This filling offers efficient breakup of water with minimum resistance to air flow. The drift eliminators effectively remove water from the discharge air.



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Plus Complete Engineering Data?

The new, LOLINE Bulletin (No. 5.1.902) is a unique brochure—now you can have all the information you want from one convenient source. Mechanical and structural features are explained, complete engineering drawings and capacity tables are included. You can get your free copy by writing today on your company letterhead — no obligation, of course.

INDUSTRY'S PARTNER FOR PROGRESS

COOLING TOWERS
GAS & AIR TREATING EQUIPMENT

REPRESENTATIVES
IN PRINCIPAL CITIES
FROM COAST
TO COAST

J.F. Pritchard & Co.
OF CALIFORNIA
A DIVISION OF J. F. PRITCHARD & CO.
Dept. 589, 4625 Roanoke Parkway, Kansas City 12, Mo.

Electrically Heat . .

(*Continued from page* 105)

els is thermostatically controlled by means of a mixing valve at temperatures of 90 to 110 F. The actual temperature of the water circulating in the space heating ceiling panels is determined by the operating engineer, who is guided by a chart evolved from experience during previous periods of similar atmospheric conditions. The tempering of the hot water that is taken from the top of the storage vessels is accomplished by using proportionate amounts of cold water returned from the building heating panels.

The central control panel in the Senate house has gages indicating the temperature of the outlet and return at the mixing valves, the space temperature of certain key rooms, and the temperature and pressure of the liquids at the inlet and outlet of the several pumps.

The circulation system to the domestic hot water service is generally maintained at 160 F by means of similarly utilizing the cold return from the heat exchangers as is done with the space heating equipment.

Compare Costs of Steam, Electric Heating

Because the use of electric energy for heating college and university buildings in the U.S. is most unusual, a comparison of unit costs of the methods described in this article with the unit cost of the conventional method used for heating comparable buildings in a typical institution in this country is of interest.

Oberlin college physical plant data is selected for purpose of such comparison because the writer has accurate information available from this institution. Steam for the heating of Oberlin college buildings included in the cubage shown in the table below is supplied from a central source and generated in a modern plant which was described in the

TABLE 1—UNIT COST OF SPACE HEATING using steam as the heat source is less expensive than heating electrically, as shown by the following comparison:

	University of London		Oberlin college
	Direct electric Senate house	Thermal storage Birbeck college and other	Steam, 1954-55
Building volume, cu ft	5,151,927	2,358,065	13,775,900
Heating days	259	259	272
Degree days, 65 F	4533	4533	5722
Electricity used, kwhr	5,000,535	2,238,820	
Steam used, lb per hr			53,110,300
Electricity, kwhr per 1000 cu ft of building	974	1064	
Steam, lb per 1000 cu ft of building			3855
Electricity kwhr per 1000 cu ft per deg day	0.215	0.235	
Steam, lb per 1000 cu ft per deg day			0.674
Cost per kwhr	$0.01299	$0.01299	
Cost per lb of steam			$0.00145
Cost per 100 cu ft of building per deg day	$0.00279	$0.00289	$0.00122

Exhibiting in the American Welding Society Show in Philadelphia April 2, 10, 11 Booth 636

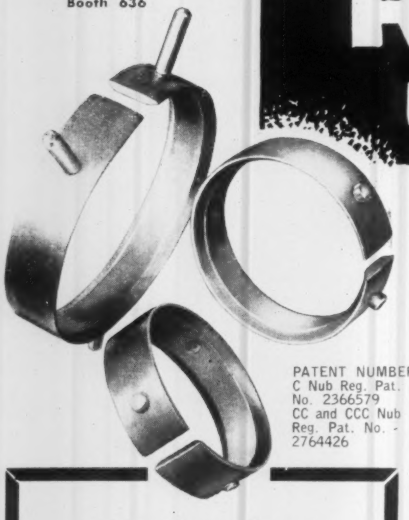
ROBVON BACKING RINGS...

APPROVED BACKING RINGS FOR WELDING PIPE, VALVE, and FITTING JOINTS

1. **Immediate precise close tolerance fit up upon insertion.**
2. **Consistent root penetration and fusion.**
3. **Radiographic quality welds.**
4. **Ease of handling in both shop and field operations.**

Available in Carbon Steel, Wrought Iron, Chrome Alloys, Stainless Steel, Aluminum and Copper.

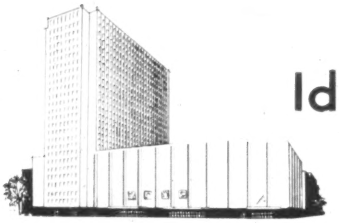
Robvon Also Manufactures Machined Rings to Customers Specifications



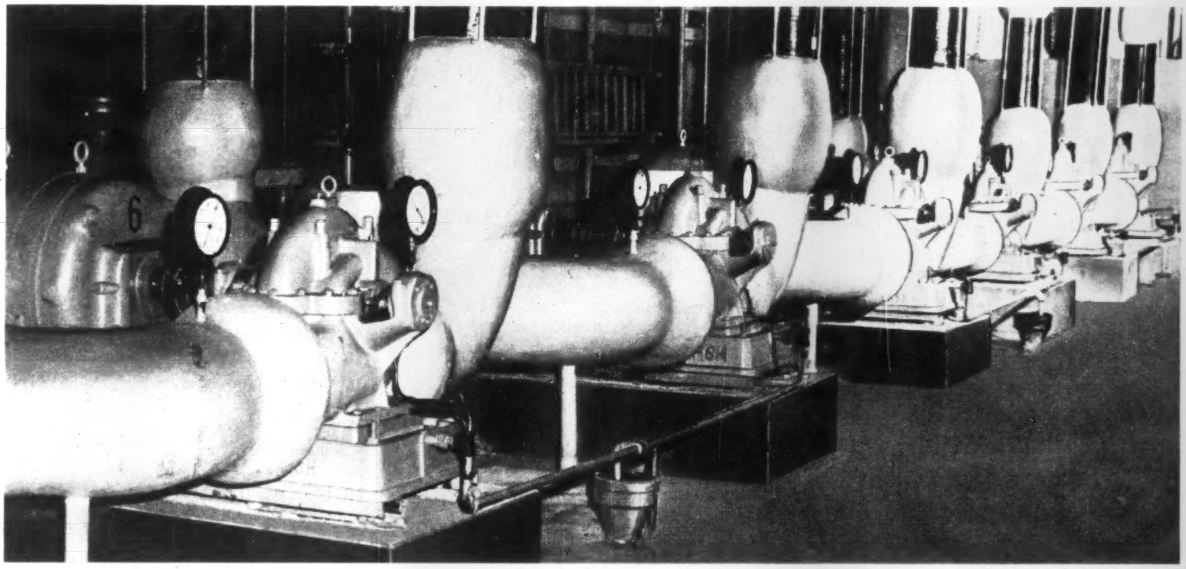
PATENT NUMBERS
C Nub Reg. Pat. No. 2366579
CC and CCC Nub Reg. Pat. No. - 2764426

Write for our latest literature Bulletin No. 56-2 and Folder No. 1

ROBVON BACKING RING COMPANY
675 Garden Street
Elizabeth, New Jersey, U.S.A.



Ideal "climate" helps draw crowds to New York's new Coliseum where...



13 AMERICAN-MARSH PUMPS

circulate up to 31,650 g.p.m. of water for air conditioning service

A lot of water? Yes, the cooling requirements are enormous in this busy "showplace of the nation!" The result is a pumping installation any engineer-contractor team could specify and install with pride and confidence.

Altogether, thirteen American-Marsh Type HLM and HIM Pumps were selected for outstanding dependability and efficiency. Installed in the Coliseum for this high static head system are:

CHILLED WATER PUMPS—*Two* Type HIM, Size 6", Capacity 1650 GPM each. *One* Type HIM, Size 5", Capacity 1200 GPM. *Three* Type HLM, Size 8", Capacity 2500 GPM each.

COOLING TOWER PUMPS—*Three* Type HLM, Size 12", Capacity 3750 GPM each. *Two* Type HLM, Size 8", Capacity 2400 GPM each.

BOOSTER PUMPS—*Two* Type HIM, Size 6", Capacity 1800 GPM each.

All are horizontal split case type centrifugal pumps, specifically fitted for the job. Each individual pump was fully tested and proved to meet or exceed all specifications before shipment.

This standard-practice thoroughness and attention to quality means that *you* can specify American-Marsh Pumps with full confidence! Write today for data—or call your nearby A-M Representative.

OWNER—Triborough Bridge & Tunnel Authority
ARCHITECT—Leon and Lionel Levy
MECHANICAL ENGINEER—Guy B. Panero
STRUCTURAL ENGINEER—Dr. Jacob Feld
GENERAL CONTRACTOR—Walsh-Fuller-Slattery
HEATING, VENTILATING AND AIR CONDITIONING CONTRACTOR—Almirall & Co., Inc.

WRITE TODAY for Bulletin 350 describing HLM-HIM PUMPS

(The types installed in the Coliseum)

AMERICAN-MARSH PUMPS

BATTLE CREEK MICHIGAN

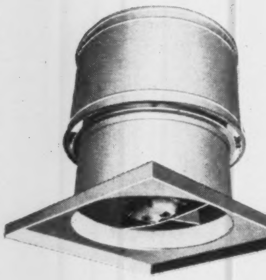
Pumps and Pumps only Since 1873

In Canada: American-Marsh Pumps (Canada) Ltd., Stratford, Ont.

CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR TESTING, PROCESSING, BOILER FEED, FIRE PROTECTION, ETC.

FOR *Fast*

DISCHARGE of AIR at HIGH VELOCITY



allen

VERTICAL DISCHARGE FAN

- ***Keeps fumes from leaking back through building openings***

Whenever you face the problem of discharging fumes through a roof so that they will not short-circuit back through building openings, you'll find the solution in this Vertical Discharge Fan. It is designed especially for industrial applications that require the removal of a large volume at high velocity. It is fabricated of zinc-coated iron sheet with welded construction throughout. Automatic wing dampers open with air blast, close weather-tight when not operating. Available as "VD" direct drive with motor mounted inside air stream or as "VDR" with motor mounted outside throat of ventilator—both in a wide range of capacities and sizes.

See Sweet's Architectural File, Section 20b or write for catalog.

ALLEN ENGINEERED VENTILATION

ALLEN COOLER & VENTILATOR INC.
ROCHESTER, MICH.
Roof Ventilators for Every Industrial Need

FILL OUT AND SEND COUPON

ALLEN COOLER & VENTILATOR INC.
ROCHESTER, MICHIGAN

Please send me informative literature on your complete line of roof ventilators.

Firm
Name
Position
Address
City, State

Electrically Heat . .

(*Continued from page 264*)

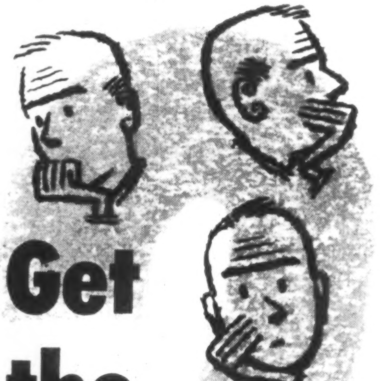
July 1950 HPAC. [An article by the author on the heating results experienced in Oberlin's new auditorium building was also published in the May 1956 HPAC.] The Oberlin college data is for the heating season 1954-1955.

As would probably be suspected, the unit cost of space heating using steam as the heat source is less expensive than heating electrically.

The figures indicate also that the cost of space heating by means of circulating water heated by electricity that is stored in large vessels is more expensive than using electrical resistance units. On the basis of the figures in the tabulation it would seem that space heating with steam is 42 percent of the cost of the thermal storage method and 44 percent of that of electric resistance units. Also that direct electric heating is about 4 percent less than the cost of thermal storage. ‡

You know those rare days when *everything* checks? Air smells good. Food tastes terrific. Even the old face looks good in the mirror. *Today* can be that kind of day. Just do two things. Call your doctor for a thorough medical checkup for cancer. Then write out a check—a nice fat one—to the American Cancer Society, and send it to "Cancer" in care of your local Post Office.

AMERICAN CANCER SOCIETY



Get the Answers!

To your equipment installation problems

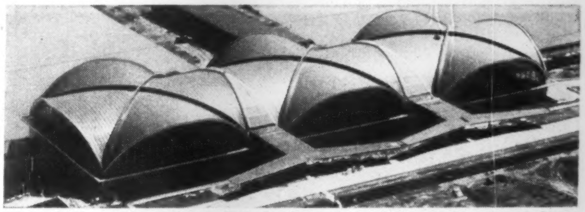
If you work with—

CENTRIFUGAL COMPRESSORS
RECIPROCATING COMPRESSORS
COOLING TOWERS
AIR HANDLING UNITS
PACKAGED LIQUID CHILLERS
FANS
BLOWERS
PUMPS
PIPING
BOILERS
UNIT HEATERS

or What have you?...

Korfund's complete line of products give you the right answer the first time to your installation, vibration and noise problems. Write for Bulletin 44 which gives full details.

THE **KORFUND** COMPANY, INC.
KORFUND VIBRATION CONTROL — SPRINGS — RUBBER — CORK
48-01F Thirty Second Place, Long Island City 1, N. Y.
In Canada: 510 Canal Bank, Ville St. Pierre, Montreal



Lambert-St. Louis Municipal Airport. Hellmuth, Yamasaki and Leinweber, Architects.

Another fine heating assignment for Petro

The Petro-Kewanee burner-boiler units shown below were chosen for one of the most magnificent new buildings in America. Says *Architectural Forum,* "St. Louis has now given the age of air travel its first appropriate terminal." This "new kind of big room" is a series of concrete cross-vaults 412 feet long.

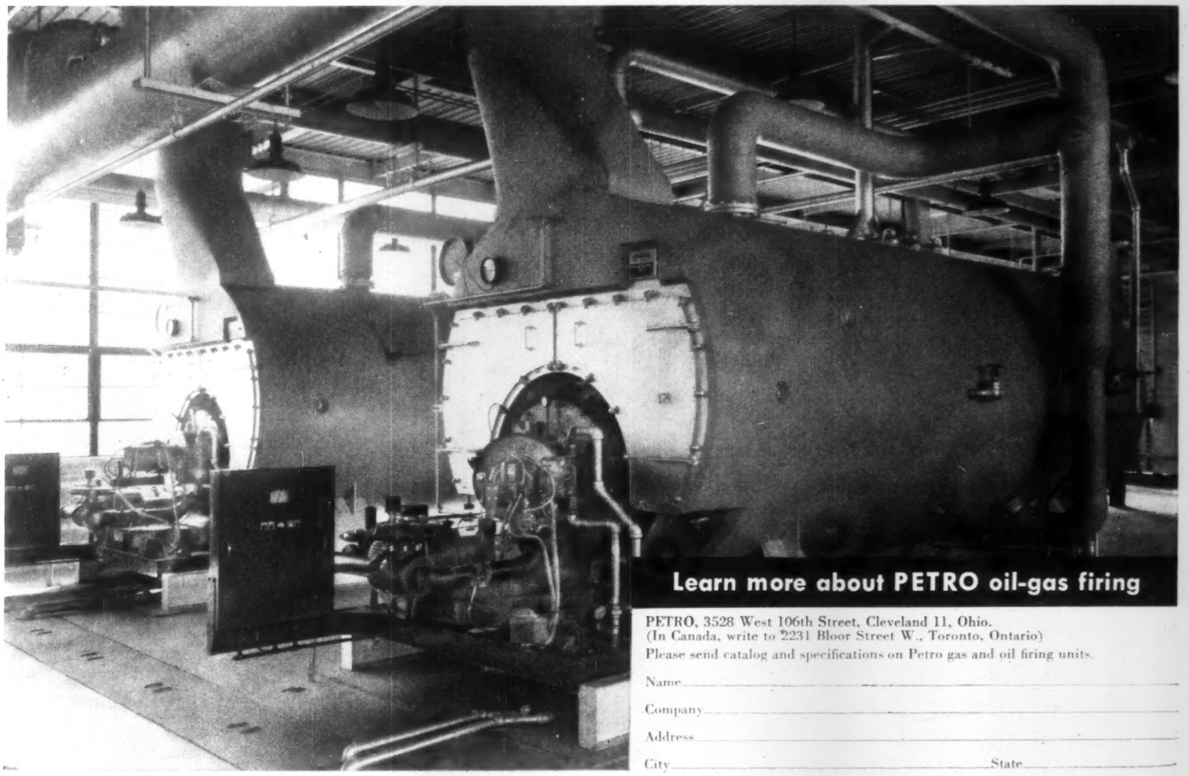
The heating plant consists of two Petro forced draft firing units with matched Kewanee boilers. They are fully integrated units with all burner components factory engineered, installed and mounted. The burners are equipped to fire either oil or gas with peak efficiency, and fuels can be switched quickly.

The Petro forced draft firing system can be used with a Scotch type boiler as shown here, or can be applied to any other type of boiler. Models are available for modernization of existing firing systems or as a component part of a packaged boiler-burner unit. Hundreds of Petro distributors and dealers are located in all parts of the United States and Canada to help you and your consulting engineer in planning boiler room modernization or construction.

For more information please mail the coupon below.

PETRO® HEATING AND POWER EQUIPMENT

Heating contractors: American Power & Piping Corp., St. Louis. Consulting Engineers: Ferris & Hamig, St. Louis. Petro distributor: Becker Marsden Company, St. Louis.



Learn more about PETRO oil-gas firing

PETRO, 3528 West 106th Street, Cleveland 11, Ohio.
(In Canada, write to 2231 Bloor Street W., Toronto, Ontario)

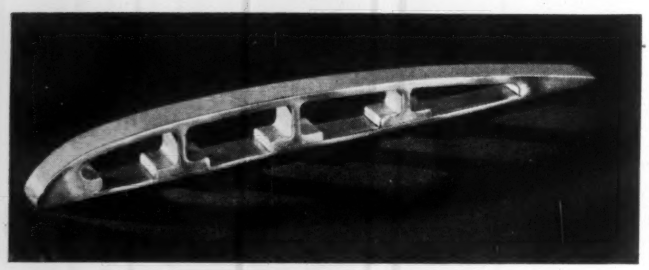
Please send catalog and specifications on Petro gas and oil firing units.

Name ____________________

Company ____________________

Address ____________________

City __________ State __________



Cross section shows structural superiority of Aeromaster's new, extruded aluminum-alloy blades in diameters from 9′ to 22′.

NEW! **EXTRUDED ALUMINUM Blades on AEROMASTER* fans only**

AEROMASTER'S new, extruded aluminum blades combine in one design the advantages of a light weight metal, a hollow structure and the superior strength of wrought metal . . . Silicon-magnesium aluminum alloys resist corrosion. Their fine grain structure, high tensile strength and increased endurance limit eliminate danger from wear, vibration, and metal fatigue . . . true airfoil blade sections assure maximum air delivery . . . adjustable blade pitch angle permits decrease of fan load to an accurate minimum horse-power requirement.

The AEROMASTER fan is easily assembled *in the tower.* No special handling equipment is necessary. AEROMASTER fans cost less to install, less to operate, less to maintain!

For more details write to KOPPERS COMPANY, INC., Aeromaster Fan Dept., 6803 Scott Street, Baltimore 3, Maryland.

KOPPERS

Aeromaster Fans

Engineered Products Sold with Service

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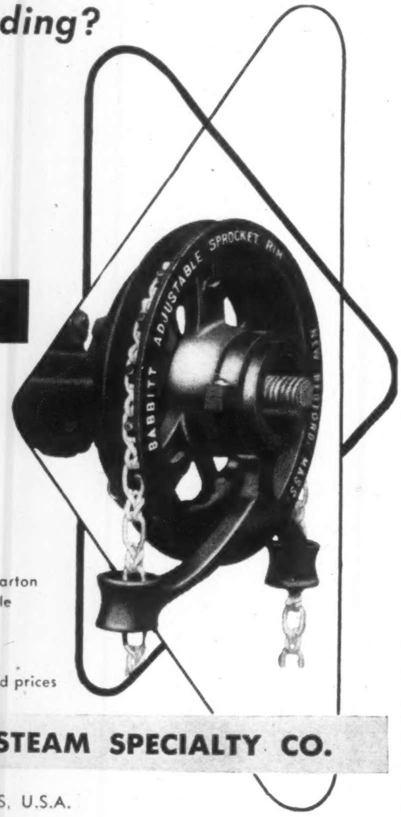
Building or Expanding?

THINK of
SAFETY
CONVENIENCE
ECONOMY
THINK of

Babbitt

Adjustable
SPROCKET RIM
with Chain Guide



- Simplifies pipe layout
- Fits any size valve wheel
- Easy to install and operate
- Operates any valve from plant floor
- Time and money saving fixture
- No maintenance, first cost *only* cost
- Packed, completely assembled, one to a carton
- Hot galvanized, rust-proof chain available for all sizes
- Easy to follow instructions with each unit
- Your supplier carries complete stocks
- Write for new descriptive catalog sheet and prices

Babbitt STEAM SPECIALTY CO.

7 BABBITT SQUARE, NEW BEDFORD, MASS, U.S.A.

WHO'S WHAT . . .

(New personnel, promotions)

▶ *EGGELHOF ENGINEERS, INC.*—Wilson A. Green, district manager.

▶ *BORG-WARNER CORP.*—J. F. Weiffenbach, director of research and engineering.

▶ *AIR MOVING AND CONDITIONING ASSOCIATION*—Officers elected for 1957 are: W. H. Rietz, president of Ilg Electric Ventilating Co., president; R. W. Nelson, vice president of American Air Filter Co., Inc., vice president; F. W. McKenna, chief engineer of Kennard Corp., vice president; J. P. Johnson, sales manager of ventilating division of Swartwout Co., secretary-treasurer. Mr. Rietz also serves as a director of the association.

▶ *AMERICAN RADIATOR & STANDARD SANITARY CORP.*—W. G. Senft, vice president of manufacturing for air conditioning division; Robert Wilson, product manager, succeeding Mr. Senft.

▶ *ALUMINUM ASSOCIATION* Newly elected officers include: S. D. Den Uyl, president of Bohn Aluminum & Brass Corp., president; Arthur V. Davis, chairman of the board of Aluminum Co. of America, honorary chairman of the board; Everett G. Fahlman, president of Permold Co., chairman of the board. Named association vice presidents are: Russel B. Caples, president, Anaconda Aluminum Co.; W. E. Dunlap, president, Aluminum Extrusions, Inc.; Frank R. Nichols, president, Nichols Wire & Aluminum Co.

▶ *GENERAL ELECTRIC CO.*—C. Benjamin Ramsdell, general manager of commercial and industrial air conditioning department.

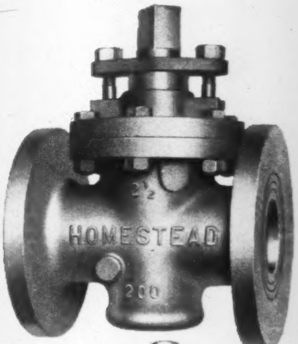
Multiple Port, 100% Pipe Area or Venturi

HOMESTEAD

offers you one source for

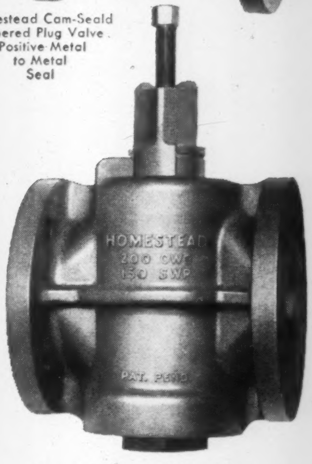
ALL TYPES OF PLUG VALVES

ALL TYPES OF PORT OPENINGS

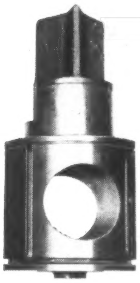


Homestead Cam-Seald Tapered Plug Valve. Positive Metal to Metal Seal

Diamond Port or "V" Port for Throttling



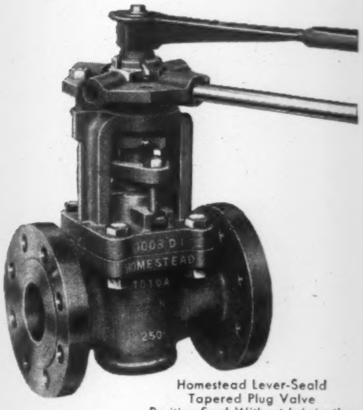
Homestead Lubricated Plug Valve High Pressure Chemical Seal



Round Port 100% Pipe Area

Name the type of valve you need in the metal or alloy you require with the port opening you want—and we can furnish it. Or if you have a valve problem that defies solution, write us, naming the fluid, concentration, temperature, pressure, valve size, function and frequency of operation. We will be happy to recommend the best and most economical valve for your service conditions.

For complete information on Homestead Plug Valves



Homestead Lever-Seald Tapered Plug Valve Positive Seal Without Lubrication

Rectangular Port 100% Pipe Area

MAIL THE COUPON NOW!

Please send me information on the following Homestead Plug Valves:

☐ Lubricated ☐ Lever-Seald ☐ Cam-Seald

Name________________ Title________

Company____________________

Address____________________

City________________ State________

Rectangular Port Venturi

HOMESTEAD VALVE MANUFACTURING COMPANY

P.O. Box 128 *"Serving Since 1892"* Coraopolis, Pa.

GOULDS PUMPS, INC., Seneca Falls, New York

Check bulletins you'd like to receive:

☐ Pump Fundamentals. A brief outline of the characteristics, operation and criteria for selecting reciprocating, rotary, and centrifugal pumps.

☐ 710.1 "Close-cupld" Centrifugal Pumps.

☐ 721.6 Single-stage Double-suction Pumps.

☐ 725.4 Centrifugal Chemical Pumps.

☐ 726.1 Vertical Centrifugal Pumps.

Name__________ Title__________

Company__________

Address__________

City__________ Zone_____ State__________

How to buy a better pump

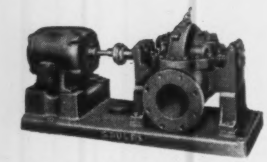
When you have to choose from dozens of pumps of different types and brands, it's hard to tell which will work best for you at the least cost.

However, when you know what to look for and how to look, you can match a pump to your needs almost exactly.

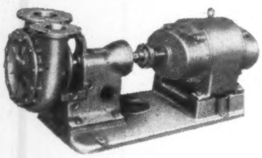
Just five of hundreds of bulletins we've prepared to help you buy wisely and well are offered above. Send for them and use them when you need a general purpose pump.

When you have a particular application in mind, write us the essentials. We'll be glad to advise you on the pump or pumps that will work best for your purpose.

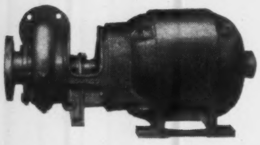
4 general purpose pumps



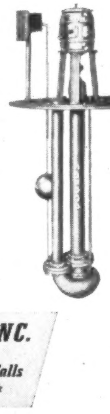
1. For large capacity pumping, the Goulds Fig. 3405. 33 sizes with capacities up to 6400 GPM; heads to 425 ft. Send for Bulletin 721.6.



2. For economical handling of hot, corrosive or abrasive liquids, the Goulds Fig. 3715 stainless steel pump. 9 sizes with capacities up to 720 GPM; heads to 200 ft. Send for Bulletin 725.4.



3. For use where space is at a premium, the Goulds Fig. 3655 "close-cupld" pump. 20 sizes with capacities up to 2000 GPM; heads to 400 ft. Send for Bulletin 710.1.



4. A submerged-type sump pump for depths of 3 to 20 ft., the Goulds Fig. 3047. 4 sizes with capacities from 10 to 650 GPM; heads up to 65 ft. Send for Bulletin 726.1.

MEMBER

Goulds PUMPS INC. Seneca Falls New York

SALES OFFICES: Atlanta • Boston • Chicago • Houston • New York • Philadelphia • Pittsburgh • Tulsa

WHO'S WHAT

Continued

▶ *WORTHINGTON CORP.*—Sylvan R. Hirsch, assistant to vice president-engineering; Frederick B. Seel, manager of engineering at company's Holyoke Div., succeeding Mr. Hirsch.

▶ *INLAND STEEL PRODUCTS CO.*—E. J. Cullen, elected to the board of trustees of the National Warm Air Heating and Air Conditioning Association. Mr. Cullen is manager of commodity products at Inland.

▶ *JAS. P. MARSH CORP.*—F. O. Pauls, advertising manager.

▶ *AIRTEMP DIV., CHRYSLER CORP.*—R. L. Lovelace, assistant to vice president in charge of manufacturing; D. E. Beatty, manager of production planning and scheduling; C. E. Henry, industrial engineer; C. E. Corrigan, supervisor of time study and methods.

▶ *BATTELLE MEMORIAL INSTITUTE*—Dr. B. D. Thomas, director; E. E. Slowter, secretary. Members of newly formed executive committee are: Clyde Williams, John S. Crout, David C. Minton, Jr., and Messrs. Thomas and Slowter.

▶ *MAGNESIA INSULATION MANUFACTURERS ASSOCIATION*—Recently elected officers are: Alvin M. Ehret, Jr., president of Ehret Magnesia Mfg. Co., chairman of the board of governors; J. A. O'Brien, vice president of Johns-Manville Corp., vice chairman; E. H. Luchs, vice president of Mundet Cork Corp., treasurer.

▶ *TRANE CO.*—Robert P. Marshall, taking part in a planning program in preparation for the factory superintendent position of the company's proposed air conditioning equipment plant.

NURSERY
Every bearing noise tested
Designed for low noise level

The motors with the built-in "hush"

Louis Allis designed them specifically for quiet operation

When you place an air-conditioning unit in close proximity to people, you must avoid disturbing noise characteristics.

In hospitals, nerve-racking resonance is therapeutically harmful. Even in less demanding installations like hotels and office buildings, silence is a prime specification for those concerned with guest comfort or increased worker efficiency.

Louis Allis motors are specifically designed for silent, vibrationless operation. Housings, bearings, end brackets are all thoroughly tested for *quietness*.

Result? A built-in "hush", particularly welcome in commercial installations.

Find out more about L. A. motors. Contact your nearby Louis Allis District Office, or write for our file-size Reference Bulletin 1700, "The New L. A. Line of Electric Motors." The Louis Allis Company, 453 East Stewart Street, Milwaukee 1, Wisconsin.

LA-112

LOUIS ALLIS

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE-SPEED DRIVES

DAVIS

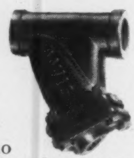
VALVE SPECIALTIES
FOR STEAM,
AIR
OR GAS

Davis offers a complete line of valve specialties including relief valves, altitude valves, pump governors, pressure regulators and emergency valves. No matter what the control problem, there's a Davis specialty product to meet the need. Contact Davis today for precision control valves.

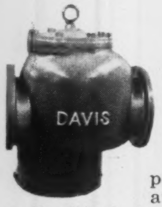
RUGGED, DEPENDABLE STRAINERS FOR AIR-CONDITIONING SYSTEMS

Davis builds a high quality line of strainers that are ideal for installing in today's modern commercial air conditioning systems. They are easy to service and are available in a wide range of sizes. Three of the most widely used are shown below:

No. 75
"Y" TYPE



Bolted cap "Y" Type Strainer for easy access for cleaning. Blowoff at lowest point—no sediment pocket! Complete range of sizes: ⅜" to 14"... available in semi-steel, bronze or steel bodies, screwed or flanged. Brass, stainless or monel screens. For steam, air, gas or fluids ... pressures to 1500 psi.



No. 76
BASKET
TYPE

The No. 76 Strainer has a cylindrical basket with perforated sides and bottom — easily lifted out for cleaning. Large body passage for low pressure drop. Sizes ½" to 24"... bronze, semi-steel or steel bodies ... brass, stainless, monel steel baskets ... special meshes available. Ask for recommendations.

No. 77 BASKET TYPE

Similar to No. 76 except for applications where lowest possible pressure drop is desired.

WRITE FOR BULLETIN 800

Davis
DAVIS REGULATOR COMPANY

2541 So. Washtenaw • Chicago 8, Illinois

WHO'S WHAT

Continued

▶ *JOSEPH T. RYERSON & SON, INC.*—Alfred J. Olson, general sales manager for Chicago plant; Theodore L. Kishbaugh, manager of Los Angeles steel service plant; Wayne D. Dukette, manager of Los Angeles plant; L. Paul Lee, manager of stainless steel sales at Milwaukee plant; Robert A. Daggit and Scott Vrooman, sales managers, Chicago plant.

▶ *AMERICAN AIR FILTER CO., INC.*—Charles S. Stock, elected to board of directors of Producers' Council, Inc. He will serve a two-year term. Mr. Stock is manager of the Herman Nelson Unit Ventilator Products Dept. of AAF.

▶ *YOUNG RADIATOR CO.*—Harry M. Gill, advertising manager.

▶ *A. M. BYERS CO.*—J. Frederic Byers, Jr., chairman of the board; B. M. Byers, president, succeeding his brother.

▶ *ALLIS-CHALMERS MFG. CO.*—Boyd S. Oberlink, a director; Archie D. Dennis, assistant secretary and assistant treasurer; Pickens Johnson, assistant secretary.

▶ *BJORKSTEN RESEARCH LABORATORIES, INC.*—Dr. Melvin W. Aarons, senior physicist in solid state physics section.

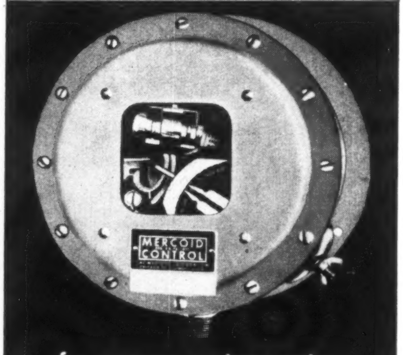
▶ *TUBE TURNS PLASTICS, INC.* Earl Erich, sales manager.

▶ *WHIRLPOOL-SEEGER CORP.*—Robert Willemin, secretary.

▶ *AMERICAN RADIATOR & STANDARD SANITARY CORP.*—George M. Maier, general manager of heating plants in manufacturing department of plumbing and heating division.

MERCOID®
WEATHER RESISTANT
CONTROLS

VISIBLE
CALIBRATED DIAL
ON-OFF SWITCH POSITION
OPERATING POINT INDICATORS



for pressure or temperature

HERMETICALLY SEALED CONTACT
ZINC PLATED STEEL CASE
OUTSIDE ADJUSTMENTS

FOR OUTDOOR SERVICE
OR OTHER APPLICATIONS
(NEMA 1A, 2, 3, 4)

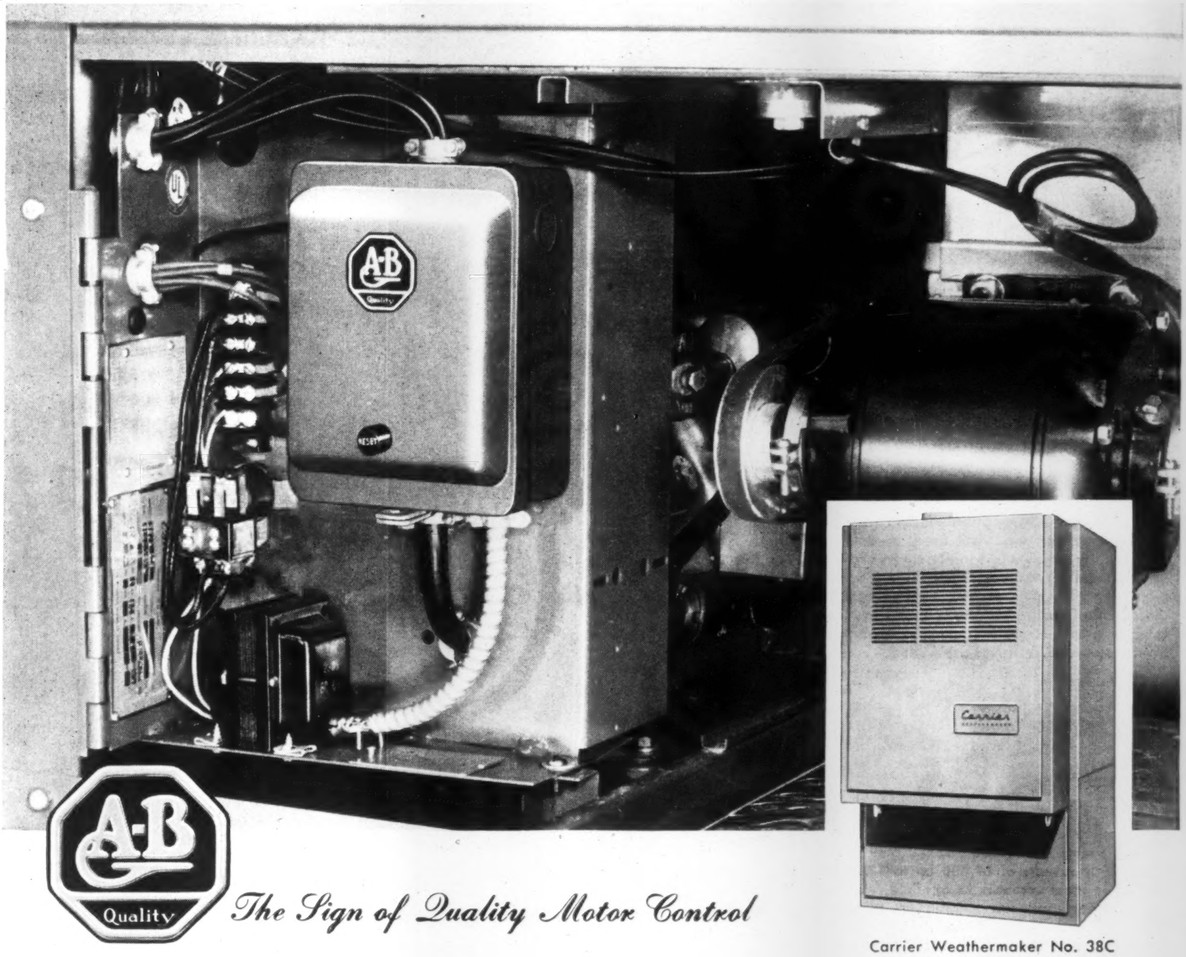
Drip Tight
Semi-Dust Tight
Weather Resistant
(Weather Proof)
(Splash Proof)
(Sleet Proof)
(Moisture Resistant)
(Rain Tight)
Weather Tight
(Hose Test)

Write for catalog No. 857W which also lists general purpose controls (NEMA 1) and explosion proof controls (NEMA 7, 9, 9A).

THE MERCOID CORPORATION
4201 Belmont Ave., Chicago 41, Ill.

Carrier *Weathermaker Air-Conditioning Units*

operated by ALLEN-BRADLEY TROUBLE FREE MOTOR CONTROLS

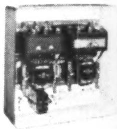


A-B Quality

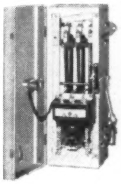
The Sign of Quality Motor Control

Carrier Weathermaker No. 38C
air conditioner for residential use

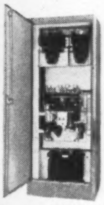
Typical Allen-Bradley Quality Motor Controls



Bulletin 736
Part Winding
Motor Starter



Bulletin 640
Manual Resistance
Type Starter



Bulletin 746
Automatic Autotransformer Type
Starter

To obtain reliable service year after year, from an air-conditioning or refrigeration unit, it must be equipped with a starter built to "take it". . . and over the last 25 years Allen-Bradley Bulletin 709 solenoid starters have established their reputation for dependable operation.

This performance is due to the simplest starter mechanism yet conceived . . . the solenoid switch with only ONE moving part. No pins, pivots, or bearings to corrode and bind . . . no jumpers to break. The cadmium silver alloy contacts never require troublesome cleaning, filing, or dressing.

In addition, Allen-Bradley Quality Motor Controls have these "plus" values . . . overload relays that retain their accuracy irrespective of time or operating conditions . . . highly efficient magnetic circuits that hold through wide voltage fluctuations . . . white interiors that make for easier wiring in dark locations. Specify Allen-Bradley . . . for millions of trouble free operations.

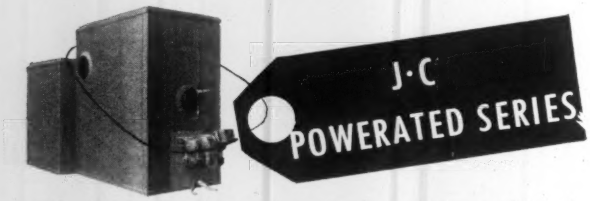
Complete information on Allen-Bradley Quality controls is contained in the A-B Handy Catalog . . . an abbreviated encyclopedia on motor control. Write for your copy, today.

Allen-Bradley Co.
1335 S. First St., Milwaukee 4, Wis.
In Canada—
Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

JACKSON & CHURCH FURNACES

HANDLE DIFFICULT HEATING JOBS



Jackson & Church engineering has produced a new Powerated furnace line which matches today's heaviest duty requirements. These new furnaces develop static pressures up to 1½" W. C. with lock-seam, leakproof casings designed to carry the heaviest air load over the unit for air conditioning. Oil, gas or dual-fuel firing with outputs from 152,000 to 3,800,000 Btu. The J-C Powerated Series incorporates the latest advances in modern industrial and commercial heating.

J·C GAS·FIRED
SUSPENDED SERIES

Available for heating plants, stores, churches, schools and other large structures, these new gas-fired models have inputs of 200,000 to 400,000 Btu, with some units approved either as horizontal furnaces or as blower type heaters. These J-C units provide the convenience of gas firing plus all the advantages of suspended type heating such as savings in floor space and almost limitless zone heating possibilities. Drawer type burners for easy accessability, easy installation. J-C gas-fired suspended furnaces are built for minimum maintenance.

J·C OIL·FIRED
SUSPENDED SERIES

Space-saving oil-fired suspended models, available in a wide range of sizes with outputs of 89,000 up to 1,000,000 Btu, these easily installed units are most versatile in application. They can be installed singly or in batteries, and can supplement other heating for plant expansion and they are readily adapted to year round air conditioning. These dependable units solve many commercial and industrial heating problems.

J·C
DIRECT·FIRED SERIES

With outputs from 400,000 to 2,000,000 Btc, and available for oil, gas or dual-firing, J-C Direct-Fired units are ideally adapted for large commercial or industrial heating jobs. They may be installed on the floor, or suspended either inverted or horizontally. They are self contained, automatically controlled units equipped with induced draft fan and air circulating blowers. J-C Direct-Fired Unit design makes savings possible in both installation and maintenance costs.

J-C
JACKSON & CHURCH — FURNACE DIVISION
Saginaw, Michigan

WHO'S WHAT

Continued

▶ *EUTECTIC WELDING ALLOYS CORP.*—Fred F. Roehll and Joseph F. Quaas, directors. Mr. Roehll is vice president and national sales manager, while Mr. Quaas is recently appointed vice president in charge of manufacturing and production. Leon D. Richardson has been named assistant general sales manager.

▶ *OLIN MATHIESON CHEMICAL CORP.*—Edward M. Grady, assistant to vice president for sales of Western Brass Mills Div.

▶ *UNITED STATES STEEL CORP.*—John H. Morava, president of United States Steel Supply Div.

▶ *SIMPSON ELECTRIC CO.*—Earl F. Waldenmeyer, chief meter specification engineer.

▶ *FRIEZ INSTRUMENT DIV., BENDIX AVIATION CORP.*—Donald C. McDonald, director of engineering.

▶ *STANFORD RESEARCH INSTITUTE*—Fred B. Ortman, associate director.

▶ *TURNER CONSTRUCTION CO.*—Michael J. Roach, vice president; H. Thom Noyes, chief engineer, succeeding Mr. Noyes.

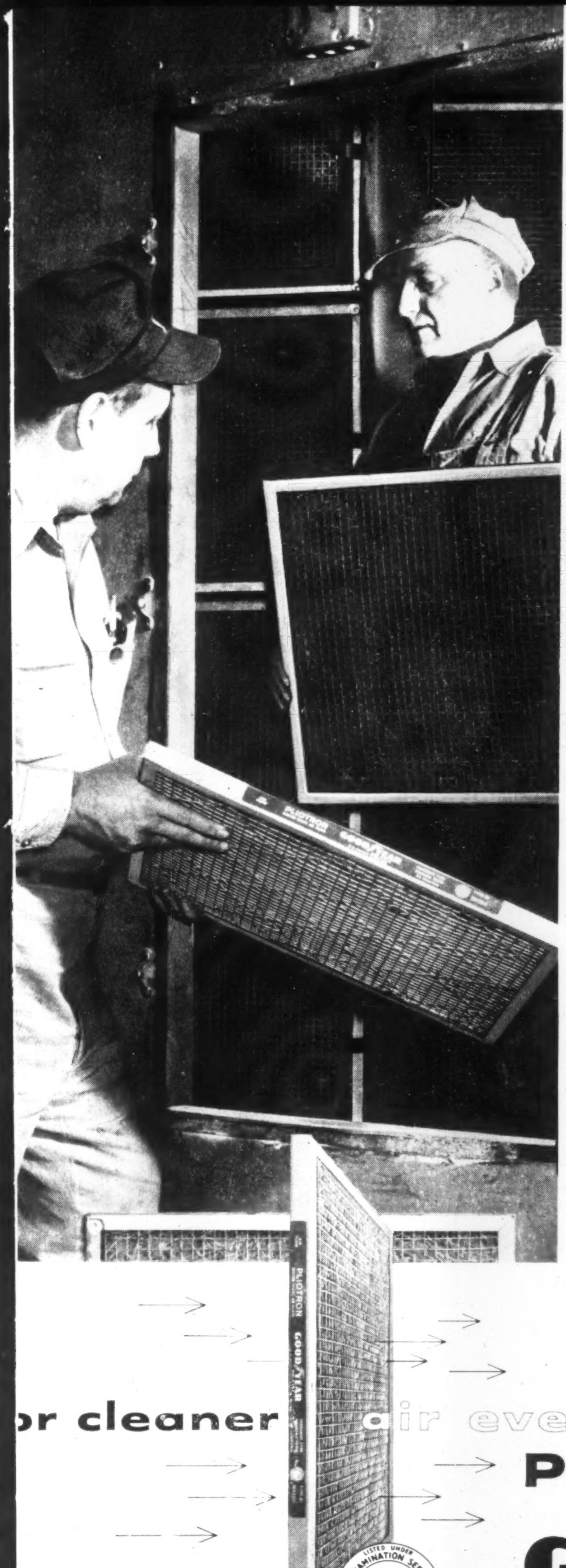
▶ *WOLVERINE TUBE, DIV. OF CALUMET & HECLA, INC.*—L. G. Fox, manager of products; J. A. Harty, manager of advertising and sales promotion.

▶ *WARNER ELECTRIC BRAKE & CLUTCH CO.*—Alonzo A. Neese, chairman of the board.

▶ *AMERICAN GAS ASSOCIATION*—Ralbern H. Murray, assistant secretary of industrial and commercial gas section.

▶ *VOORHEES WALKER SMITH & SMITH*—Charles Haines, a partner; Victor J. De Masi, a junior partner.

▶ *NATIONAL BUREAU OF STANDARDS*—John H. Eiseman, recipient of the "Award of Merit" of the operation section of American Gas Association. Mr. Eiseman is a member of the gas chemistry section of the bureau.


PLIOTRON
GOODYEAR
LISTED UNDER REEXAMINATION SERVICE OF UNDERWRITERS' LABORATORIES, INC.
UL

They're building reputations

installation
by
installation!

No question about the success of this filter installation in a large, modern bakery. It does a better job of filtering air to the cooler—taking the heat off 100,000 loaves of bread a day on their journey from oven to wrapper. And it saved the user a projected 70% of his "normal" annual filter costs.

Naturally, this reflected plenty of credit on the men who recommended and installed PLIOTRON super-filters. Customers are always quick to appreciate work that saves them time lost in premature replacements. And usually they pass on their satisfaction—in more business and valuable word-of-mouth advertising.

When you install PLIOTRON, they have plenty to talk about, too: It captures up to 5 times as many fine dirt particles as ordinary filters. Since it's a depth-loader—not a surface-loader—it works efficiently far longer between cleanings. And when dirty, a quick bath restores its full efficiency.

So it's easy to see why users are willing to pay the extra initial cost of PLIOTRON filters. And these super-filters boost the reputation of everyone who recommends them—installation after installation. For details, write:

Goodyear, P.O. Box 288, Akron, Ohio.

or cleaner air everywhere-

PLIOTRON AIR FILTER BY

GOODYEAR

THE GREATEST NAME IN RUBBER

. M. The Goodyear Tire & Rubber Company, Akron, Ohio

Keep Pace ...
CUSTOM BILT RESIDENTIAL AIR CONDITIONING
FLOCOLD
HOT SHOT
SPOTAIRE LRC
Central-Plant Air Conditioners...
Flexzone...
PERMA-FAN
SPASAVER
HELPFUL AIR CONDITIONING
...REFRIGERATION DATA
Yours Free! *
SPOTAIRE VRC
AIR COOLED CONDENSER
COOLING TOWER
PACKAGED WATER CHILLER
The New FLOCOLD Product Coolers
Extended Surface for STEAM-WATER and DIRECT EXPANSION
AIR HANDLING U
Guarantees Customer Satisfaction

Yes...
I would like to receive complete data.( )
Or, just send me items checked. ( )

drayer-hanson
SINCE 1910

3301 Medford Street • Los Angeles 63, California
(Division of National-U.S. Radiator Corporation)

WHO'S WHAT

Continued

▶ *DELCO APPLIANCE DIV., GENERAL MOTORS CORP.*—Vaughn H. Hardy, chief engineer.

▶ *WALTER KIDDE CONSTRUCTORS, INC.*—E. Warren Bowden, executive vice president.

▶ *WATERMAN-WATERBURY CO.*—Jack Searls, assistant to president.

▶ *AIR REDUCTION CO., INC.*—George E. Hawkins, executive vice president.

▶ *FOSTER WHEELER CORP.*—Kenneth S. Brundige, manager of condenser department. He will be in charge of design and sales.

▶ *C. S. ZIEGLER & CO.*—Milton A. Hanna, manager of Tri-Sul-Ite Div.

▶ *PENNSYLVANIA SALT MFG. CO.*—Appointments within newly formed industrial division include: Hugh C. Land, general manager; George R. Lawson, director of marketing; Arthur F. Bixby, manager of marketing research.

▶ *AUTOMATIC TEMPERATURE CONTROL CO.*—Robert B. Seidel, recipient of honorable mention as the "Most Outstanding Young Electrical Engineer of 1956." The award is sponsored by Eta Kappa Nu Association, national electrical engineering honor society. Mr. Seidel is president of Automatic Temperature Control Co.

IN THE TERRITORIES . . .

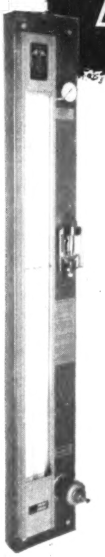
(Recent sales appointments)

▶ *FISHER GOVERNOR CO.*—Clarence B. Petty & Co., representative for Boston and New England area. Sales engineers that will assist Mr. Petty are Walter Taylor and Steve Lord.

▶ *MAMMOTH FURNACE CO.*—H. O. Degner of Aerovent Fan Engineers, representative for line of industrial direct fired heaters in Chicago, northern Illinois.

▶ *HOFFMAN SPECIALTY MFG. CO.*—R. W. Lang, Jr., representative to cover western Michigan.

Petrometer
SERIES 1400
LIQUID DEPTH GAUGES



ACCURATE and EASY TO INSTALL

Available in 4 Models, Petrometer Series 1400 Tank Gauges operate on the sound principle of hydrostatic pressure. No moving parts, no expensive electrical or electronic equipment. Large vertical scale gives accurate, easy-to-see reading. And construction features make installation easy.

For complete information send for Bulletin 6004

Petrometer

All Petrometer Gauges are guaranteed for one year

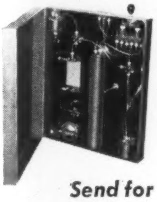
Measure Specific Gravity Accurately!

. . . and from a remote point

The Petrometer remote reading Specific Gravity Indicator is accurate to .001 Sp. G. unit, with interpolation to .0005 unit! It's easy to install . . . and operates on the simple, sound principle of a differential bubbler.

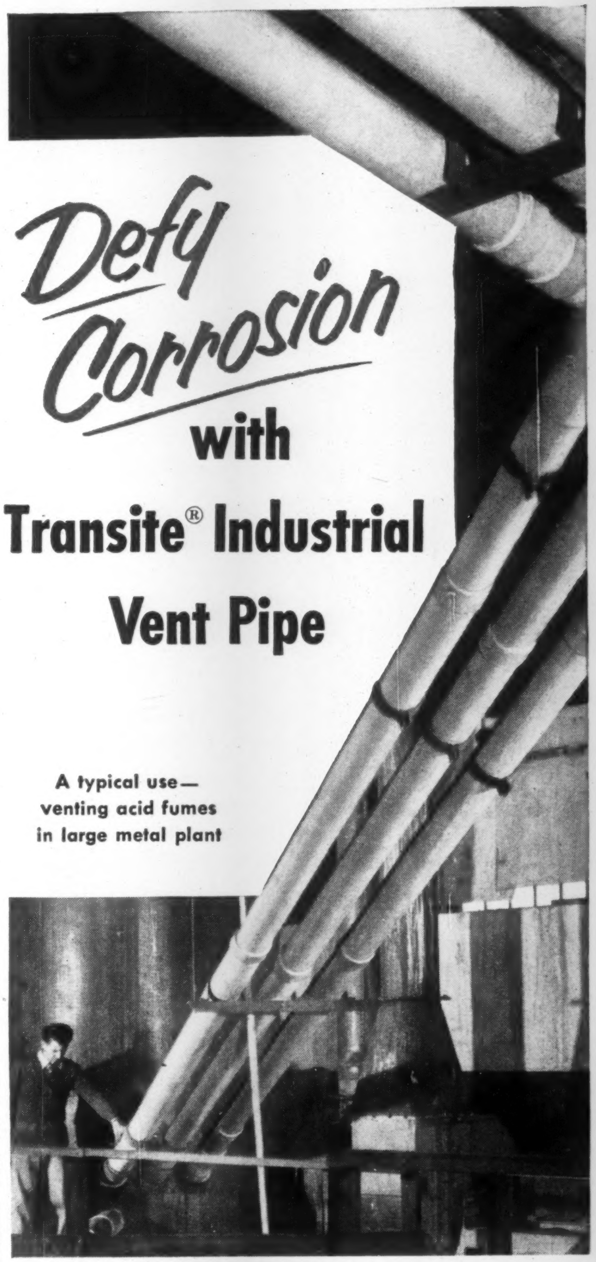
An ideal instrument for plant or laboratory for measuring specific gravity of any liquid . . . paints, fuel, resins, pharmaceuticals, chemical solutions.

All functional parts are conveniently mounted on rear of panel, accessible by swinging open the cabinet door.



Send for Bulletin 7004

Petrometer
CORPORATION
43-22 TENTH STREET, LONG ISLAND CITY 1, N.Y.



Defy Corrosion with Transite® Industrial Vent Pipe

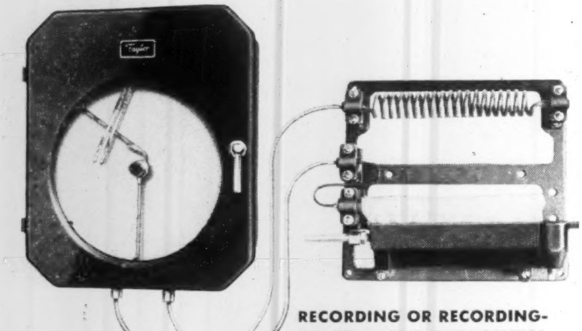
A typical use— venting acid fumes in large metal plant

In severe venting services, Transite's outstanding performance is a matter of record. Made of asbestos and cement, two of nature's most indestructible materials, it resists the attack of most fumes, vapors, and dusts.

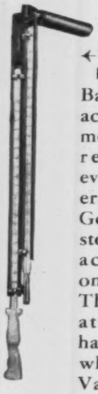
Installed indoors or out, Transite Industrial Vent Pipe can't rust or rot, never needs paint, nor other protective coating. Wide variety of fittings makes it adaptable to any layout. For more information, write Johns-Manville, Box 14, New York 16, N.Y. In Canada, Port Credit, Ontario.

Johns-Manville
TRANSITE INDUSTRIAL VENT PIPE
An Asbestos-Cement Product

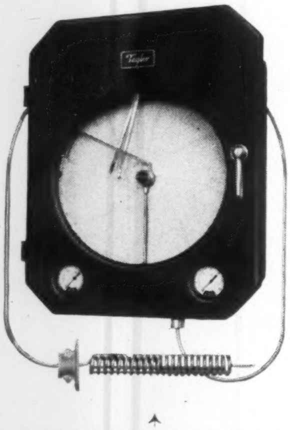
TAYLOR AIDS *to Air Conditioning*



RECORDING OR RECORDING-CONTROLLING HYGROMETER with bottle or continuous water feed. Recommended under the following conditions: Good air circulation; panel advantageously located within apparatus room or duct for best circulation across the bulbs. Available with bottle-feed or continuous water supply.



NEW ← TAYLOR SLING PSYCHROMETER Basic standard for accurate measurement of humidity—redesigned for even simpler operation. New 9" Gold Back etched-stem thermometers accurate within one scale division. The new rigidly-attached swivel handle folds back when not used. Variety of F. and C. ranges available.



↑

TAYLOR FULSCOPE* TEMPERATURE CONTROLLER. Keeps lever motors, diaphragm valves, dampers, etc., in proper sequence to make your air conditioning system work perfectly. Automatically compensates for load changes. Controls refrigeration compressors. Gives you automatic seasonal changeover.

• • •

Ask your Taylor Field Engineer about these instruments, or write for **Catalog 5.** Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

*Reg. U.S. Pat. Off.

Taylor Instruments
MEAN ACCURACY FIRST

WHO'S WHAT

Continued

▶ *AIRTHERM MFG. CO.*—Kenneth B. Little Co. and Robar, Inc., representatives for Cincinnati and St. Paul, respectively.

▶ *TRANE CO.*—A. G. Barry, to specialize in handling self contained air conditioning lines in Chicago area; Ernest Cummings, assigned to Atlanta office; Donald J. Girard, manager of Syracuse sales office. Recent graduates from company's specialist training program and their assignments are: Jerry G. Bartos, Dallas; Virgil E. Carrier, Tulsa; Raymond E. Crawford, Greensboro, N.C.; William Dudek, Seattle; James J. Duffy, Detroit; Edward L. Duncan, West Hartford, Conn.; Thomas M. Elliott, Jr., Toledo; Kenneth A. Gablin, Philadelphia; Sam H. Harper, Jr., Houston; David R. Hodgson, St. Paul; Robert D. Krouner, Buffalo; Robert W. Leonard, San Francisco; Richard E. Shimshak, Pittsburgh; William G. Wofford, Jr., Dallas; Raymond R. Youell, Milwaukee; Hubert R. Gangl, Jr., David L. Jessee and Roger O. Zoellner, assigned to home office; Ted D. Digel, Glen T. Narfason, William H. Reid and Ernest Schellenberg, to join company's Canadian sales operation.

▶ *BRUNNER MFG. CO.*—Joseph R. Connors, district sales manager for Philadelphia territory. Walter A. Runciman succeeds Mr. Connors as service manager.

▶ *DRAVO CORP.*—Brod and McClung, Inc., distributor for most of Oregon, part of Washington; J. A. Neymeyer Co., a similar appointment for 15 counties in Iowa.

▶ *YORK CORP.*—Charles P. Strickland, Jr., industrial sales manager of southwest district comprised of Louisiana, Texas, parts of Alabama, Arkansas, Mississippi, New Mexico. Deane Worlein has been named manager of York-Detroit Wholesalers. He will direct distribution of York products throughout lower Michigan.

▶ *AMERICAN RADIATOR & STANDARD SANITARY CORP.*—John R. Warnock, manager of newly established Detroit sales district for plumbing and heating division. The district covers Michigan, western Ohio, northwestern Indiana.

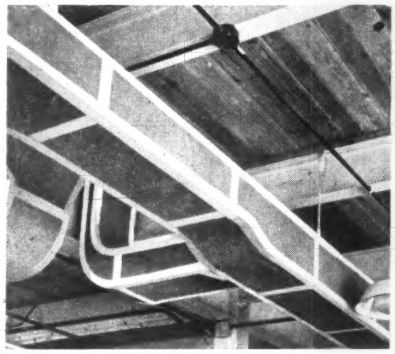
▶ *ARMSTRONG CORK CO.*—New members of company's insulation division field sales organization and their assignments are: John W. Lowe, Atlanta; Richard H. McIntosh, David T. B. Norton and Scott S. Miller, Philadelphia; Edward H. Johnson and Robert

COSTS MORE and WORTH IT!

Grant Wilson

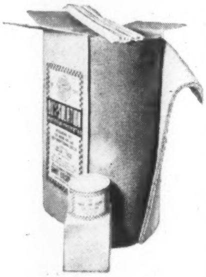
DUX-SULATION

ASBESTOS PROTECTED



Despite the advent of many lower priced insulations, many of the nation's leading architects and engineers continue to specify Grant Wilson Dux-Sulation. One reason is that Dux-Sulation is just about indestructible — can't possibly be crushed or cracked. Its insulation and sound absorption efficiency, high to start with, *cannot* be impaired during installation.

Dux-Sulation can't powder, shift or sift. There are no "thin" spots, even at corners. There is no deterioration of any kind, no change of any kind. Insulating values are constant, indefinitely!



Special adhesive and tape (supplied) obviate the need for any additional "fasteners". If desired, Dux-Sulation can be applied in the shop and still withstand all necessary handling. On all counts, especially on projects where nothing less than the best is acceptable, Dux-Sulation is still your logical choice — the insulation you can specify with *absolute confidence* . . . no ifs, ands or buts!

write for
Bulletin 577H-3

Grant Wilson inc.
ASBESTOS and INSULATING MATERIALS
141 WEST JACKSON BLVD. • CHICAGO 4, ILLINOIS

For Low-Cost Heating Plant Exhausting and Industrial Venting ...Investigate Quickdraft

Capacities of 56 standard and heavy duty models (6 to 30-inches diameter) . . . 140 CFM to 16,766 CFM with or without stacks. Greater capacities on special order.

- ★ NEW ACID-RESISTING FINISHES
- ★ NO FAN OBSTRUCTION IN EXHAUST LINE
- ★ BLOWER OPERATES IN CLEAN OR OUTSIDE AIR
- ★ CAN BE USED WITH OR WITHOUT STACK

FOR HEATING PLANTS AND INCINERATORS. Quickdraft provides constant draft required for efficient and economical combustion. It prevents noxious concentrations of deadly fumes and dangerous accumulations of explosive gases from escaping into buildings. It eliminates pulsating or chattering, puffing, smoking and sooting. Quickdraft's acid-resisting vitreous enamel finish assures trouble-free performance.

FOR INDUSTRIAL VENTING. Quickdraft eliminates down-time for cleaning and replacing fan blades . . . cuts maintenance costs. It is ideal for venting paint booths . . . abrasives, corrosive gases, noxious fumes, high temperatures and moisture. For severe exposure to acids, specify our new acid-resisting plastic finish in addition to our standard acid-resisting vitreous enamel finish.

FOR MOVING AIR . . . in or out of buildings through ducts . . . Quickdraft is outstanding in efficiency.

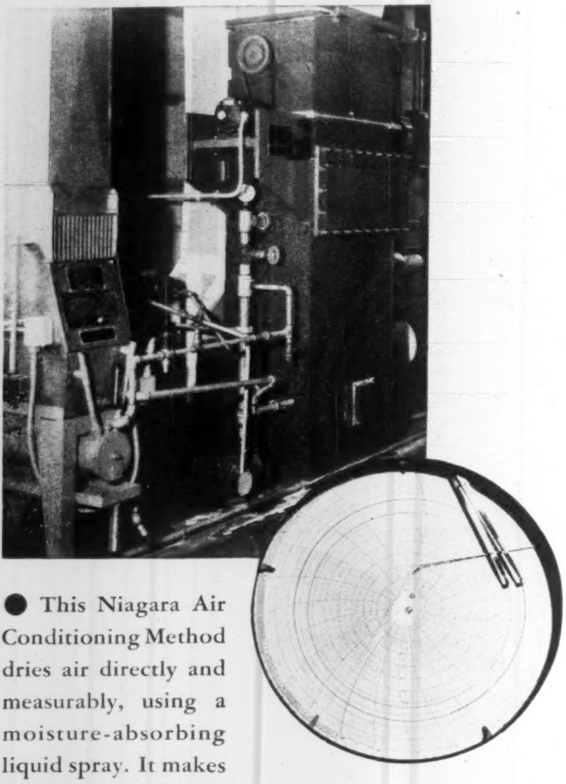
Send for engineering data on your heating or venting applications . . . today.

Quickdraft
Engineering
Data
N-394-QD

Quickdraft COMPANY

Dueber-Hampden Building, P. O. Box 87-K Canton 1, Ohio

EXACT CONTROL
of Moisture Content
To Improve Your Product
or Protect Your Materials
or for Processes or Tests



● This Niagara Air Conditioning Method dries air directly and measurably, using a moisture-absorbing liquid spray. It makes humidity control a separate function from lowering or raising temperatures and gives you precise control with thermostats alone; no moisture-sensitive devices are needed. You have simpler, more trustworthy, less expensive control instrumentation. Niagara precise-control installations have the best record for reliability.

Niagara Air Conditioning provides you with any temperature and relative humidity you need. Using "Hygrol" absorbent, it is not expensive to operate, saving the refrigeration commonly used to condense moisture and making re-heat unnecessary in most cases. It gives large capacity with compact, easily-maintained equipment. Ask for Descriptive Bulletins #112 and #121. Address Dept. HP

NIAGARA BLOWER COMPANY
405 Lexington Ave. New York 17, N. Y.
District Engineers in Principal Cities of U. S. and Canada

WHO'S WHAT

Continued

C. Nichols, Baltimore; James A. Boylan, Cleveland; Donald R. Calvert, Buffalo; William H. Haelig, Jr., Dallas; Richard J. Halder, St. Louis; Richard R. Voorhees, New York.

▶ *KRAMER TRENTON CO.*—Hans P. Peterson, head of reorganized New York City sales office.

▶ *CARRIER CORP.*—John N. Gillham, president and board member of Air Conditioning Corp., Louisville distributor for Carrier. Mr. Gillham comes to the company from Carrier's Dallas office, where he was district manager for the Unitary Equipment Div.

▶ *WORTHINGTON CORP.*—E. Weston Hammond and J. R. Matullo, managers of Los Angeles and Newark district offices, respectively. Mr. Hammond replaces J. G. Murphy, who has been appointed special representative.

▶ *FURNAS ELECTRIC CO.*—Rocke International Corp., appointed as export sales division for the company.

▶ *JOHNS-MANVILLE CORP.*—C. A. Cocks, New York district sales manager of Celite Div. He will be responsible for sales in New England, New York, New Jersey, Maryland, Virginia, District of Columbia, part of Pennsylvania.

▶ *LIMA REGISTER CO.*—John Thomas, salesman to cover Florida, Mississippi, Alabama, Georgia, the Carolinas, Louisiana, Virginia.

▶ *RESEARCH PRODUCTS CORP.*—A. R. Struck, district salesman in company's southwest division. He will serve suppliers in Oklahoma, Arkansas, north Texas.

▶ *MODINE MFG. CO.*—Harry J. Clark, eastern regional sales manager; Associated Thermal Products, Inc., representative in New York territory.

▶ *BABCOCK & WILCOX CO.*—Claude L. Huey, manager of Atlanta district.

▶ *FIELD CONTROL DIV.*—Theodore L. Smith, representative for draft controls in Virginia, Maryland, Delaware, eastern Pennsylvania, Washington, D.C.; William D. Bogh, to represent draft control line in southern California.

☆ ☆ ☆

Manufacturers' Agents

Are you interested in securing additional lines?

We are occasionally asked by our manufacturer advertisers to suggest the names of manufacturers' agents in various sections of the country whom they can contact in regard to representation of their industrial and large building heating, piping, and air conditioning products.

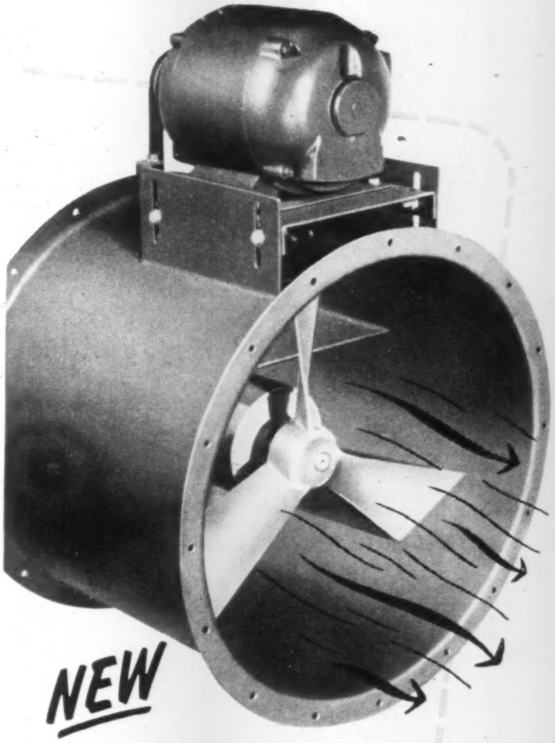
If you would like your name listed on our records for inquiries we may receive on your territory, we invite you to write us. There is no charge in connection with this service.

Heating, Piping & Air Conditioning

6 NORTH MICHIGAN AVENUE
CHICAGO 2 ILLINOIS

☆ ☆ ☆

expel FUMES, HEAT AND DUST at LOW COST



NEW PROPELLAIR®

belt driven Tubeaxial Fans

Type "BT" Propellair Fans can be purchased and operated at low cost to handle difficult atmospheres such as highly corrosive, explosive, inflammable, grease or dust-laden air. Straight-line design permits easy, inexpensive installation. Platforms and duct elbows are eliminated. The externally mounted Robbins & Myers motor, sealed cast iron housed bearing assembly, air-tight drum and belt-tube provide complete protection. Standard models can handle temperatures up to 450° F. Propellair "BT" tubeaxial fans are available in sizes 16" to 60" for from 2000 to 85000 CFM air delivery.

WRITE FOR BULLETIN NO. 620-HP

R&M **PROPELLAIR®**

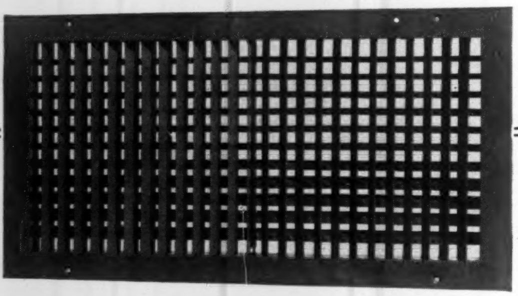
DIV. OF ROBBINS AND MYERS, INC.
SPRINGFIELD, OHIO

Certified Ratings PFMA

MAN COOLER SKY-BLAST VANEAXIAL EXTENDED SHAFT

MOVING AIR IS OUR BUSINESS

Now You Can Have Absolute Air Control
UP . . . DOWN
LEFT . . . RIGHT
. . . *ANY VOLUME!*



A-J

AIR CONDITIONING GRILLE

With Detachable Volume Control

Here's the perfect grille for air conditioning! Specially designed, extruded aluminum louvers reduce air friction to minimum. Available in four styles — vertical, horizontal or a combination with either deflection for face bank of bars.

Tamper-proof Adjustment

Louver bars are mounted in frame and mullion by patented process. Positive setting with hand tool. Can not be moved by tampering or air pressure after system is balanced. Mechanism is completely enclosed by double frame. Available with — or without metering damper described below.

Controls Air from a Whisper . . . to a Blast!
A-J
OPPOSED BLADE DAMPER

This detachable damper allows engineer to balance the system to most exacting demands. Blades operate in opposite directions simultaneously from fully opened (90°) to closed (32°). Distributes air *evenly* over entire face of grille.

Positive Gear Drive Mechanism

Drive operator consists of gear, gear track and non-metallic clutch. Works easily, locks in any position. Adjusts with Phillips screw driver.

FREE
CATALOG
Lists over 1000 types and sizes of grilles and registers. Write for it!

A-J MANUFACTURING CO.
Dept. H-3
3601 East 18th St.
Kansas City, Mo.

WHO'S WHAT

Continued

▶ *TUBE TURNS PLASTICS, INC.*—James L. Sheehy, district manager of western area, with headquarters in San Francisco.

▶ *TUTHILL PUMP CO.*—John W. See, regional sales manager of area made up of New England, New York, New Jersey, eastern half of Pennsylvania.

▶ *METALS & CONTROLS CORP.*—Richard H. Almquist and Lucky W. Somers, field engineers for Chicago area for General Plate Div.

▶ *CLEAVER-BROOKS CO.*—J. U. Kaye and Co., representative for western Pennsylvania, eastern Ohio, West Virginia, two counties in Maryland.

▶ *ACME INDUSTRIES, INC.*—Irvon E. Corwin and Valdi Landman, sales engineers assigned to Chicago regional office.

▶ *LAWLER AUTOMATIC CONTROLS, INC.*—Edward C. Oldach and Paul F. Boeckel, representatives in Buffalo area.

▶ *A. W. CASH CO.*—K. C. Brown Co., representative for Kansas, western Missouri.

▶ *AUTOMATIC SWITCH CO.*—Recently appointed distributors are: McKeever Electric Supply Co., Columbus, Ohio; Westinghouse Electric Supply Co., New Orleans; Good Supply & Equipment Co., Akron; Moore Bros. Electric Co., Flint; Schultz & Cia., S.A., Mexico City. Glidden Engineering and Equipment Co., Asco's Texas representative, has opened new offices at Ft. Worth and Corpus Christi and has relocated its Dallas office to 4924 Greenville Ave., Dallas 6.

▶ *INLAND STEEL PRODUCTS CO.*—Ben F. Kracht, district manager in charge of new New Orleans branch office and warehouse; Robert J. Morris, field engineer on Los Angeles branch staff.

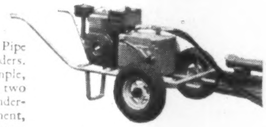
▶ *PENNSYLVANIA SALT MFG. CO.*—Appointed sales agents for "Isotron" refrigerants are: Allen B. Harvey, Northeast; Carl Stewart, New York State, western Pennsylvania; Norman K. Porter, Michigan, Ohio; I. H. Cohler Co., Chicago, northern Indiana, Iowa, Minnesota, Wisconsin; R. L. Williams, Southwest; Rudy A. Wolfe and Walter Evans, Louisiana, Mississippi, Arkansas, southern Texas including Houston and San Antonio; Len Wright, Florida.

CUT COSTS ON UNDERGROUND PIPING INSTALLATIONS WITH GREENLEE PUSHER

Save hours of time, cut job costs with this quick, easy way of installing underground pipe. With a GREENLEE Hydraulic Pipe Pusher, *one man* pushes pipe *under* streets, walks, tracks, lawns, floors, and other obstacles. No costly tearing up of paving . . . eliminates extensive ditching, as just a short trench accommodates the Pusher. No tedious tunneling, backfilling, tamping, repaving. Compact, portable, powerful. Often pays for itself on first few jobs. Thousands in use for big savings of time and labor. Two models: one for 3/4 to 4" pipe, one for larger pipe, concrete sewer pipe, drainage ducts. Write for facts today.

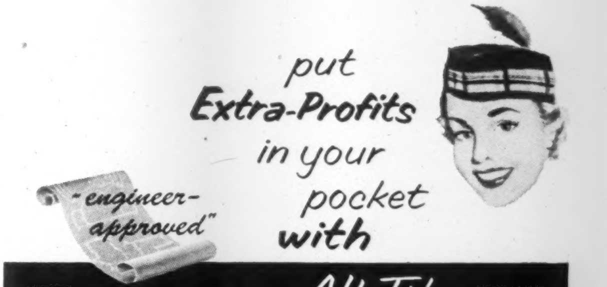
POWER PUMP

For all models of GREENLEE Pipe Pushers and Hydraulic Pipe Benders. Makes the toughest pushing jobs simple, fast. Average pushing performance: two feet per minute. Rubber-wheeled undercarriage, available as extra equipment, provides convenient, easy way to transport and move about on job location.



TOOLS FOR CRAFTSMEN
GREENLEE

Greenlee timesaving tools for plumbing and heating work: Hydraulic Pipe Pushers • Hydraulic Pipe Benders • Tubing Benders • Pipe Bits Auger Bits • Spiral Screw Drivers • Chisels • And many more
Greenlee Tool Co., 2343 Twelfth Street, Rockford, Illinois



ELGEN *All-Tite* VANE RUNNERS NOW IN COILS!

OPEN THIS END
PULL HERE THIS END UP USE NO HOOKS
Save Time and Money... with ELGEN All-Tite VANE RUNNERS

THE EASIEST AND QUICKEST WAY EVER DEVISED for installing single or double blade turning vanes in square elbows. No special tools required.

New production machinery of our own exclusive design, now enables us to produce button type Elgen All-Tite vane runners in continuous coils, effecting a savings in *your cost per job*.

COILED ELGEN ALL-TITE VANE RUNNERS MEANS . . .

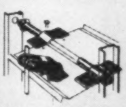
- *Less Waste!* Waste pieces due to short ends are a thing of the past. Vane runner metal is coiled in 100 foot lengths, you just pull out the exact footage needed.
- *Easier Storage!* Each coil weighs approximately 50 lbs. and is packed in a box 28" x 28" x 5". Box fits easily under bench or against wall.
- *Easier Handling!* No loose pieces lying around to get in the way or collect dirt.
- *Unrolls absolutely flat!* Vane runner metal emerges from the box at bench height . . . absolutely flat . . . ready for use.

TWO MORE ENGINEER-APPROVED ELGEN PRODUCTS THAT SAVE YOU TIME AND MONEY

ELGEN SILENT DUCT

. . . for forming "flexible" duct connectors. A one piece metal to material unit, packed in coils, unrolls absolutely flat. Makes on the spot work a cinch.

ELGEN DAMPERSET



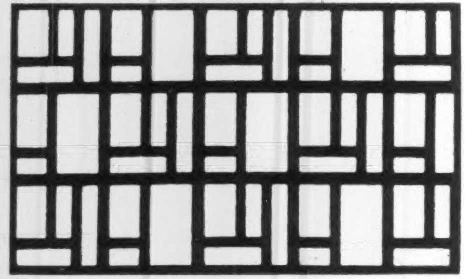
. . . for multi-blade dampers, parallel or opposed. Most perfect damper hardware developed.

ELGEN PRODUCTS ARE SOLD THROUGH LEADING JOBBERS EVERYWHERE.

Write today for free catalog and "spec" sheet!

ELGEN MANUFACTURING CORP.
41-34 39th Street, Long Island City 4, N. Y.

FOR EXTRA *Elegance* IN INTERIORS



Hendrick Perforated Metal Grilles will greatly enhance the beauty of your decorative motif. Both eye-appealing and functional, they provide more-than-ample area for the free passage of air. Available in a wide variety of designs, they're a cinch to install . . . always lie flat, don't bend or warp.

Over one hundred designs are available to choose from . . . many are obtainable only from Hendrick. For more details call on your nearby Hendrick representative or look for our catalog in the Architectural File of Sweets Catalog.

SEE OUR CATALOG IN SWEET'S

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48 Dundaff Street, Carbondale, Pa.
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Perforated Metal • Perforated Metal Screens • Wedge-Slot and Hendrick Wedge Wire Screens • Architectural Grilles Mitco Open Steel Flooring • Shur-Site Treads • Armorgrids Hendrick Hydro-Dehazer

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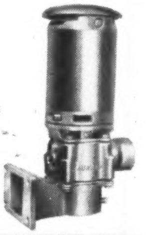
TERRIFIC!!
FAITHFUL!!

AURORA®
General Purpose
CLOSE-COUPLED
CENTRIFUGAL PUMPS

Get acquainted with this new series of versatile, economical and brilliant performers. Compactness, simplicity of design and long life suit these pumps perfectly to a wide range of duties including hot water and chemicals handling — with low NPSH characteristics to meet critical suction conditions.



TYPE BJF FLANGE MOUNTED

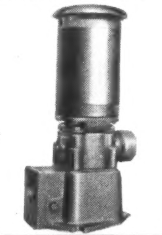
IDEAL for THESE DUTIES

AIR CONDITIONING
REFRIGERATION
COOLANT
HOT WATER
CHEMICAL*
GENERAL PURPOSE

*MAY BE FURNISHED IN SPECIAL ALLOYS TO MEET SPECIFIC CONDITIONS

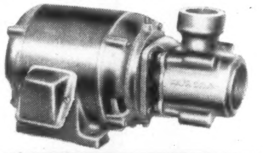
A FEW OF MANY VALUE FEATURES

SEALS or GLANDS — Available in either as desired.
SPEEDS — 3,500, 1,750 (60 cycle) and 2,880, 1,440 (50 cycle) speeds.
CURRENT — AC or DC — All voltages and phases.
MOTORS — $\frac{1}{6}$ to $7\frac{1}{2}$ H.P. drip-proof, splash-proof, totally enclosed, explosion-proof and chemical. Quiet, efficient NEMA standard.
OVERLOAD — is built-in.
COMPACT — QUIET — ECONOMICAL.



TYPE BJV BASE MOUNTED

Write for BULLETIN 119 for complete description of AURORA Quality construction and design details.



TYPE BJH HORIZONTAL

PUMPS
"by Aurora"
for EVERY NEED in INDUSTRY
for
WATER SUPPLY
CONDENSATE
BOILER FEED
PROCESSING
BOOSTER
TRANSFER
ETC., ETC.
Ask for CONDENSED CATALOG "M"

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Aurora engineers will appreciate specifications of your difficult jobs. Only the RIGHT Pump does the job RIGHT.

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AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
80 LOUCKS STREET • AURORA • ILLINOIS
EXPORT DEPARTMENT — Aurora, Illinois — Cable Address "NYABINT"

WE HEAR THAT . . .

▶ Boards of directors of both companies have unanimously approved a purchase agreement under which *DUNHAM-BUSH, INC.* would acquire the assets of *BRUNNER MFG. CO.* The plan is subject to approval by stockholders of both companies. Brunner will be operated as the Brunner Div. of Dunham-Bush, Inc. and the Brunner Co. will be a wholly owned subsidiary. *A. G. ZUMBRUN*, president of Brunner, will become a vice president of Dunham-Bush.

▶ *RECOLD CORP.* officially became the new name of *REFRIGERATION ENGINEERING, INC.* on February 15. Company officials felt that the name change was inevitable since the firm has been known unofficially as Recold since 1932 and has marketed its products under the Recold trademark since that time.

▶ *GOLDEN-ANDERSON VALVE SPECIALTY CO.* has reorganized its operational structure and expanded facilities, the firm reports. A new management group, headed by *GRANT A. COLTON*, has acquired all of the outstanding stock of the company. Mr. Colton has been appointed chairman of the board and will continue in his present capacity as president and general manager. *JOHN H. KILMER, JR.*, and *PAUL B. BRAUER* have been elected directors. The company has recently acquired additional facilities through the purchase of an Ohio company, which will be used mainly for development research and product testing. In addition, production facilities at the present plant have been enlarged.

▶ *COBELL INDUSTRIES* has been sold to a group of Cleburne, Tex., businessmen. It is reported that the company will continue to be active in the air conditioning equipment field.

▶ Construction is underway on new engineering facilities for the development by *CARRIER CORP.* of air conditioning equipment for big buildings. The laboratories will be used for the design and testing of central air conditioning systems for multistory buildings and other large structures. In addition, new equipment and methods will be developed for the growing industrial air conditioning market.

▶ The Institute of Environmental Engineers has moved to 9 Spring St., Princeton, N. J.

▶ A project is underway to develop a testing and rating code for chilled water fan coil units, according to an announcement from the Institute of Boiler and Radiator Mfrs. I=B=R is sponsoring the project

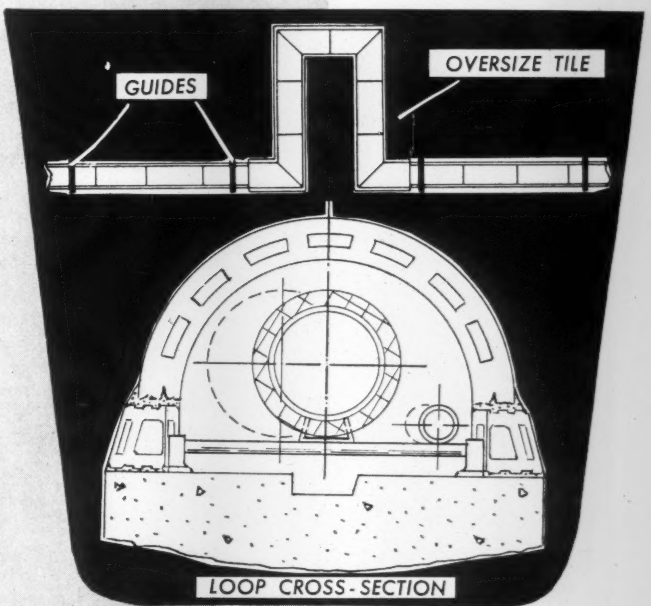
Therm-O-Tile
REG. U. S. PAT. OFFICE

CONDUIT
FOR
UNDERGROUND
PIPING

• PERMANENT • ECONOMICAL
• SIMPLE • EFFICIENT

THIS
MONTH'S
DESIGN SUGGESTION

Provide for Pipe Expansion Within
THERM-O-TILE Expansion Loops



FOR ADDITIONAL DESIGN DETAILS
AND GENERAL INFORMATION ASK FOR
Bulletin No. 9156

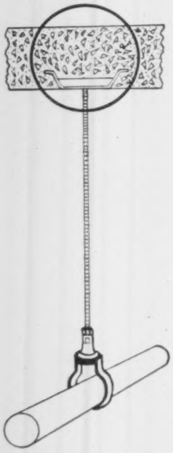
H. W. PORTER & CO., INC. • REID HAYDEN, INC.
822 Frelinghuysen Ave., Newark, N. J.
Baltimore, Md. Richmond, Va. Charlotte, N. C.
Insulation Engineers and Contractors

"WITCH"

PIPE HANGERS

FOR

HEATING – PLUMBING POWER & PROCESS



- LOW COST
- FULL LATERAL ADJUSTMENT
- DESIGNED FOR THICK OR THIN SLAB
- ONE BODY SIZE WITH REMOVABLE NUT
- EASILY REMOVED KNOCKOUT IN BOTTOM PREVENTS CONCRETE LEAKAGE

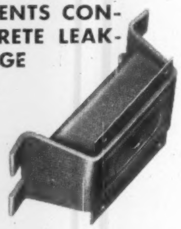


FIG. 75
CONCRETE
INSERT
(WITH KNOCKOUT)

Our catalogue illustrates a *complete* line of Pipe Hangers & Supports and is an indispensable reference book for engineers, contractors, estimators & erectors. Write for your copy now.

"WITCH"
PIPE HANGERS AND SUPPORTS

MAINTAINING OFFICES AND WAREHOUSES ACROSS THE NATION

CARPENTER and PATERSON, Inc.

18 HURLEY ST., CAMBRIDGE, MASS.

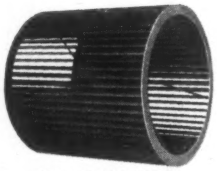
MAKE

BARRY

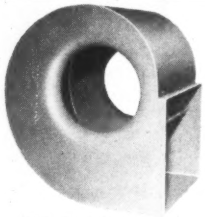
BLOWER COMPANY

your dependable low cost source of supply for

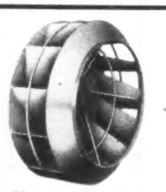
POWER FAN EQUIPMENT



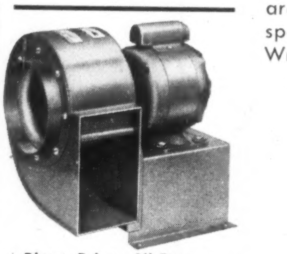
BFC, DI-DW Wheel



BFC, DI-DW Housing



BBI Blower Wheel SI-SW. Class 2.

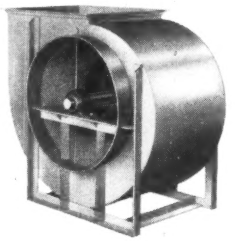


Direct Drive, All-Purpose Utility Blower

We offer users of power fan equipment a full line of blowers, multiple blower assemblies, direct and belt driven ventilating sets, cast iron blowers and various types of centrifugal blower wheels and housings. All sizes from 6" to 73".

ALL BARRY blower wheels and housings are precision made from steel, aluminum, brass, copper or stainless, and are expertly balanced and trued before shipment.

We make power fan equipment *exclusively,* and do not compete with our own customers . . . . . and, we have a high reputation for dependable quality and remarkably fast deliveries. Let us quote on our standard equipment, or upon your special sizes and specifications. Write us today.



BBI Blower, SI-SW Arrangement No. 3, class 4

REPRESENTATIVES
A few territories available for sales representatives.

BARRY BLOWER COMPANY
3100 California Street N.E. • Minneapolis 18, Minnesota

Continued

in cooperation with the American Refrigeration Institute and the Mechanical Contractors Association of America. The type of unit to be codified is defined as "a forced circulation heat exchanger with an integral fan, which may be used for heating, cooling or dehumidification or any combination thereof. It does not include direct expansion coils."

▶ Columbus, Ohio, manufacturers of refrigeration and air conditioning equipment are giving assistance in the form of material, manpower, and classroom facilities to the national study course sponsored by the Refrigeration Service Engineers Society's local chapter. The result of this cooperative assistance has been a program to train students to become industry technicians and service engineers. Among the manufacturers supporting the program are *ARMSTRONG FURNACE CO., AMERICAN BLOWER CORP., EBCO MFG. CO., LENNOX INDUSTRIES, INC., SURFACE COMBUSTION CORP.*, and *TECUMSEH PRODUCTS CO.*

▶ A new company, *POWER LINE FAN CO.*, has been formed as a division of *CHELSEA PRODUCTS, INC.* The line of products manufactured by the company includes low silhouette "dome"-type roof and wall ventilators, penthouse units, centrifugal roof ventilators and utility blowers, air blasters and man coolers, in addition to panel and tubeaxial general and pressure duty exhaust fans.

▶ *G. C. BREIDERT CO.* has been elected to membership in the Air Moving and Conditioning Association. The company, located at San Fernando, Calif., manufactures power roof ventilators for ventilation of commercial, industrial, and multiple dwelling units.

▶ *BORG-WARNER CORP.* has consolidated its Hydraline Products Div. with its recently acquired York Div. Under the consolidation, York will expand its manufacturing program to include a new line of "York-Hydraline" air conditioning products.

▶ *PLOMB TOOL CO.* has changed its corporate name to *PENDLETON TOOL INDUSTRIES, INC.* The parent company and a division will operate under the name of *PROTO TOOL CO.*, as divisions of Pendleton Tool Industries, Inc.

▶ Reversing the trend of industrial firms to move from city to suburbs, *THOR POWER TOOL CO.* has transferred its executive offices from Aurora, Ill., to the Prudential Bldg. in downtown Chicago. The company

BRIGHT IDEA! COMBINE LIGHT FIXTURES WITH KNO-DRAFT AIR DIFFUSERS

Shown is the two-story main lounge of Men's Residence Hall at the University of Washington, Seattle. Regular Kno-Draft Air Diffusers with pendant light fixture adaptations are used to achieve design simplicity and assure an uncluttered ceiling.

Kno-Draft Air Diffusers also offer the advantage of complete adjustability *after* installation. This assures *uniform temperature without drafts* throughout the conditioned area, and saves considerable preliminary slide-rule figuring.

There are Kno-Draft round, square and slotted units to meet all architectural and engineering requirements—the industry's most complete line of engineered air diffusers. Attach coupon to your letterhead and mail today for full information. Connor Engineering Corporation, Danbury, Connecticut.

CONNOR ENGINEERING CORPORATION

kno·draft®
adjustable air diffusers

◀ *Young, Richardson, Carleton & Detlie, Architects and Engineers*

Connor Engineering Corp. Dept. G-37, Danbury, Conn.

Please send data on Kno-Draft Air Diffusers. I am particularly interested in: ☐ round ☐ square ☐ slotted ☐ light fixture adaptability ☐ high pressure systems.

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Company__________

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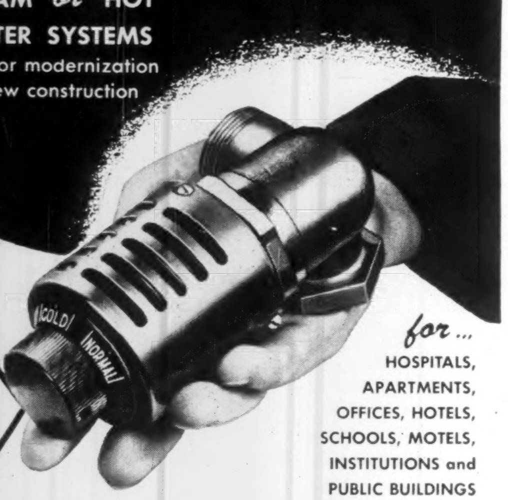
It's the . . . Sterlco®

THERMOTROL

for ACCURATE, INDEPENDENT ROOM TEMPERATURE CONTROL

STEAM *or* HOT WATER SYSTEMS

. . . for modernization or new construction



CAN BE KEY LOCKED

for ...
HOSPITALS,
APARTMENTS,
OFFICES, HOTELS,
SCHOOLS, MOTELS,
INSTITUTIONS and
PUBLIC BUILDINGS

- **COMPLETELY SELF-CONTAINED**
  Each Sterlco Thermotrol is a complete temperature control unit, easily installed in any two-pipe system in place of the manual valve. NO wiring or other external connections needed.
- **MODULATING CONTROL—NOT *on* AND *off***
  Each Sterlco Thermotrol provides steady, even control to each radiator the way YOU want it. Radiators in cold spots give off heat while those in warmer parts of the same room are automatically throttled down.
- **NO ELECTRICAL CONNECTIONS**
  No electric wiring, additional piping, or other connections are required with the Sterlco Thermotrol. Just as easily installed for modernization as for new construction.

FOR BUILDING MODERNIZATION

With a Sterlco Thermotrol on each radiator, stuffy overheated rooms, open windows, and excessive fuel bills are eliminated. You pay for only the heat you need . . . rooms are comfortably, evenly warm . . . occupants comfortable.

FOR NEW CONSTRUCTION

Here's modern ZONE CONTROL for radiant systems. The only modern solution to inefficient "on-off" valves and expensive, motorized valves.

STEAM HEATING IS MODERN, EFFICIENT and DEPENDABLE
Sterlco Products Distributed through
LEADING HEATING and PLUMBING WHOLESALERS

STERLING, INC.
3732 N. Holton St., Milwaukee 12, Wisconsin

CONDENSATION AND VACUUM PUMPS
HEATING SPECIALTIES
TEMPERATURE CONTROLS

WE HEAR THAT

Continued

has recently completed a new branch office at Richmond, Va., with *KENNETH V. BENNETT* named as manager.

▶ *ACME STEEL CO.* has relocated its general offices to 135th St. and Perry Ave., Chicago 27. The move completes the consolidation of administrative, manufacturing, sales, service and office facilities in Chicago's Riverdale area.

▶ A $2 million manufacturing plant, said to more than double the size and output of the installation it replaces, was opened recently at Milford, Conn., by *BRIDGEPORT THERMOSTAT DIV., ROBERTSHAW-FULTON CONTROLS CO.* The structure houses 180,000 sq ft of floor space.

▶ Details for the second annual stainless steel awards have been announced by *ALLMETAL SCREW PRODUCTS CO., INC.* Cash awards will be increased this year to $1500, the company reports, and will be presented for the best case histories describing the use of stainless steel fasteners as an ultimate cost reduction factor in product manufacturing. Deadline for entries is June 1, 1957.

▶ "Windmaster" draft control is now being manufactured and sold by *LIMA REGISTER CO.* The equipment and machinery for production has been moved to Lima's new plant and shipments are now being made from Lima, Ohio, the company reports.

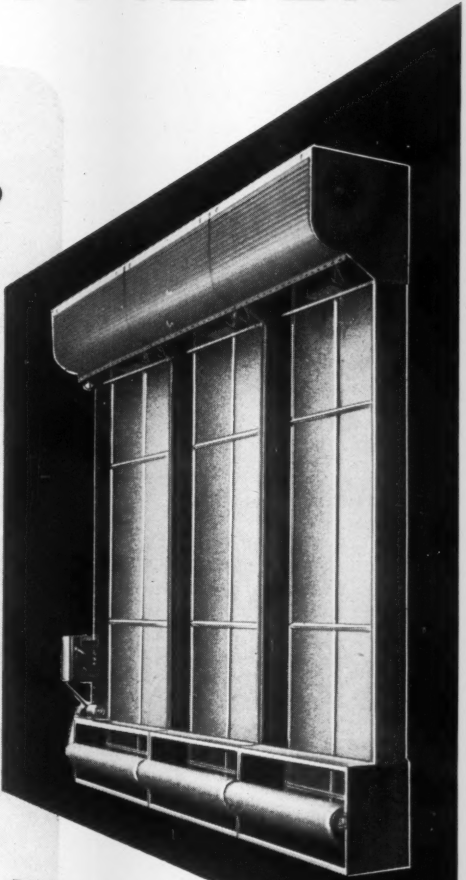
▶ *AUTOMATIC SWITCH CO.* has opened a new, modern plant on 30 acres of land in Florham Park, N.J. The facility more than doubles Asco's capacity, the company says.

▶ Two new awards for outstanding accomplishments in welding designs have been announced by the American Welding Society. They have been established by *A. F. DAVIS*, vice-president and secretary of *LINCOLN ELECTRIC CO.*, and will be known as The A. F. Davis Silver Medal Awards.

▶ *FLUOR PRODUCTS CO., DIV. OF FLUOR CORP., LTD.* has formed a separate division to design, fabricate and market a line of cooling towers for the air conditioning and refrigeration industry.

▶ Completed nine months after a three-quarter million dollar fire leveled the Cleveland plant and main offices of *GIBSON-HOMANS CO.*, a new 20,000 sq

GREEN *Sure Seal* AIR FILTER



Two Factors
Assuring Clean Air

One is the filter media itself which is made of practically endless glass filament, so well interlaced as to throw tiny road blocks in the way of every bit of air coming through. There is no direct passage for the air. It must come in contact with fiber in its way through. The entire surface of every fiber is coated with a special viscous oil which not only stops the dust particles carried by the air but anchors them permanently to the fiber.

The other factor assuring clean air at all times is the ingenious floating tubular seal which effectively seals the sides, top and bottom not only when the filter media is stationary but when it is being changed during the indexing of fresh media. Contaminated air cannot sneak into the room around the edges.

If you have a need for clean air in any department or in the whole building, you should investigate the Green Sure Seal Air Filter. But prior to discussing your problem with our engineers, why not send for our Bulletin #175 which gives full details including capacity tables?

MAXIMUM FILTRATION AREA

The entire open section of the frame is given over to filtration. Feed and take-up rolls are set away from the filtration area. They do not cut down the flow of air.

Clean Air
GREEN'S AIR FILTER

Design Features

of the GREEN

SURE SEAL AIR FILTER

- ★ **Quality of Filtering media**
- ★ **Positive Sealing at all times**
- ★ **Maximum Filtration Area**
- ★ **Choice of Automatic Controls**
- ★ **Ease in Changing Rolls**
- ★ **Wide Capacity Range**

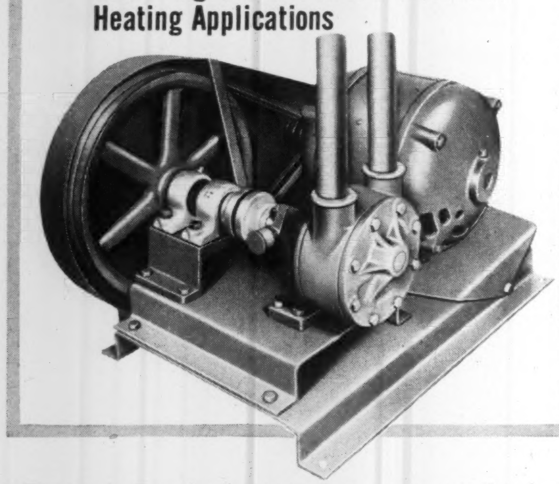
U. S. Patents Pending

THE GREEN
POWER AND PROCESS PLANT EQUIPMENT
FUEL ECONOMIZER COMPANY INC.
BEACON 3, NEW YORK
Representatives in Principal Cities

new

TUTHILL
SU
PUMP UNIT

- For Handling Heavy Fuel Oils
- In Packaged Boiler and Commercial Heating Applications

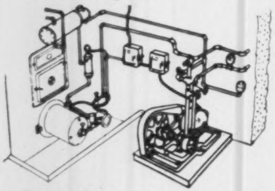


Economically priced, TUTHILL'S SU PUMP UNIT has been specifically developed for handling heavy fuel oils in commercial heating applications and with packaged boilers.

This "v" Belt Driven Unit is compact—complete units measure only 24¼" x 14⅝". Quiet operation is insured by the 2 or 4 "v" Belt Drive and the integral gear positive displacement pump design.

Construction features which provide dependable trouble-free operation, lower maintenance costs, include two ball bearing pillow blocks, one point take-up for simple adjustment of belt tension, removable belt guard and new fabricated steel base with versatile motor mounting.

SU PUMP UNITS can be furnished with a wide variety of pumps and motors for pressures up to 300 psi, capacities to 2030 gallons per hour. Sub-assemblies of pump, stub shaft, pillow block and sub-base are also furnished separately as a unit for incorporation into systems by boiler and furnace manufacturers. Write today for complete information.



Typical Application of SU Unit

TUTHILL PUMP COMPANY
947 East 95th Street, Chicago 19, Illinois
Gentlemen:
Please forward Catalog describing Tuthill SU Pump Units.
NAME________ COMPANY________
TITLE________
STREET________
CITY________ STATE________

TUTHILL PUMP COMPANY
947 East 95th Street, Chicago 19, Ill.
Canadian Affiliate: Ingersoll Machine & Tool Company, Ltd., Ingersoll, Ontario, Canada

PUMPS FOR YOUR PURPOSE

WE HEAR THAT

Continued

ft plant and a recently purchased 43,000 sq ft building are in production, the company announces.

▶ *DELAVAN MFG. CO.* has announced plans for the building of a two-story addition to its plant in West Des Moines, Ia. The addition, together with one currently under construction, will represent a 33 percent increase to present facilities, the firm reports. The structure is expected to be completed by May of this year.

▶ *WARREN STEAM PUMP CO., INC.* has completed plans to open a second plant at Peace Dale, R.I. The new facility will be a separate division of the company. Management for both plants will remain the same. *HOWARD S. RILEY*, shop superintendent, has been appointed administrative assistant to the executive vice president and will supervise operation at Peace Dale.

▶ A contract for the construction of a new plastics and "capseal" plant for *MINNESOTA MINING & MFG. CO.*, to be located at Freehold, N. J., has been awarded to *TURNER CONSTRUCTION CO.* The manufacturing facility, to be operated by 3M's Irvington Varnish and Insulator Div., will be one-story in height and will have about 105,000 sq ft of floor area.

▶ As part of its scholarship program, *TRANE CO.*, in cooperation with La Crosse State College, is sponsoring eight two-year pre-engineering $500 scholarships. The awards will be be made yearly beginning with the fall term this year. Senior boys in eight nearby Wisconsin and Minnesota counties are elibigle.

▶ *PENNSYLVANIA SALT MFG. CO.* has completed a major plant addition at its Calvert City, Ky., works. The facility will be used for the production of "Isotron" refrigerants and propellents. A second unit is under construction and scheduled for completion later this year. Both projects are part of Pennsalt's $55 million expansion program, the company reports.

▶ *PACKLESS METAL HOSE, INC.* has moved to a new office and plant at 730 S. Columbus Ave., Mt. Vernon, N.Y. The move was made in order to keep up with the increased demand for its products, the company reports.

▶ A new sales office and warehouse building has been acquired under lease by*ARMSTRONG CORK CO.* for its Cincinnati district offices. The company's insulation division district office occupied the building re-

Nineteen hundred and fifty-seven marks the Silver Anniversary of the RECOLD CORPORATION. As we pause to look back over the events of the past twenty-five years, we are forcibly reminded of the loyal support of our many friends in the refrigeration and air conditioning industry. We want to express our sincere appreciation to all of you quality conscious engineers, contractors, and consumers who have asked for, and insisted on, RECOLD. Your encouragement, coupled with the loyal support of our distributors, has made our progress possible. You have inspired us to develop more and better RECOLD equipment; and you have strengthened our belief that performance and durability are always the first consideration.

Recold

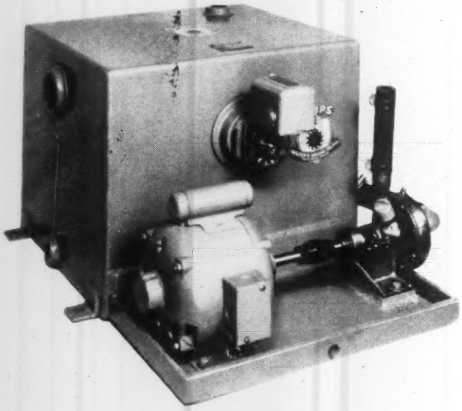
CORPORATION

7250 EAST SLAUSON AVENUE, LOS ANGELES 22, CALIFORNIA

Formerly REFRIGERATION ENGINEERING, INC.

GET THE EAGAN EAGLE...

The Condensate Pump with the Big Advantages



The EAGAN EAGLE does not require a pit even though return lines may be only a foot above the floor. It handles steam heating loads up to 8000 sq. ft. at 20 psi.

The low cost EAGAN EAGLE handles far more capacity than any similar pump at the same price (to 8000 sq. ft. EDR at 20 psi.) In addition this high quality, quiet operating condensate pump:

- Meets the demand for a condensate pump with a low return inlet to eliminate the need for a costly pit
- Contains an all bronze EAGAN centrifugal pump with non-clogging, open impeller, stainless steel shaft, life sealed ball bearing
- Has a *standard* 1/4 hp capacitor type motor, not a costly, special, close-coupled, hard-to-replace motor
- Has a flexible coupling and flexible connectors on both suction and discharge pipes to isolate the pump and prevent pipe cramp, misalignment, wear and noise
- Has a large capacity safety factor providing for at least 1 to 3 "on off" operation

Other models are available with capacities to 100,000 square feet at 200 psi, all with the outstanding features that make EAGAN condensate pumps so popular.

Write, wire or call us with your pumping problems and let us bid on your job.

WALTER H. EAGAN CO., INC.

Pump Specialists Since 1920
2336 Fairmount Ave., Philadelphia 30, Pa.
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Send me information on the EAGAN pumps checked:

☐ Condensate ☐ Boiler Feed ☐ Centrifugal
☐ Turbine ☐ Fuel Oil Pump & Heater Sets

NAME ____________

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WE HEAR THAT

Continued

cently. The modern, air conditioned facilities, with 17,500 sq ft of floor space, are located at 1057 Meta Dr., Cincinnati 37.

▶ *BOUILLON AND GRIFFITH*, professional engineers, Seattle, recently marked its 25th anniversary. Founded in 1931 by *LINCOLN BOUILLON*, the company has grown until today it is a leading engineering firm in the Pacific Northwest.

▶ With the broadening responsibilities of the local manager at each of the 17 steel service plants operated by *JOSEPH T. RYERSON & SON, INC.*, the company has changed the title of that post from plant manager to general manager.

▶ A series of factory schools for the air conditioning personnel of distributors, utilities and dealers is being held by the "All-Year" Air Conditioning Div. of *SERVEL, INC.*

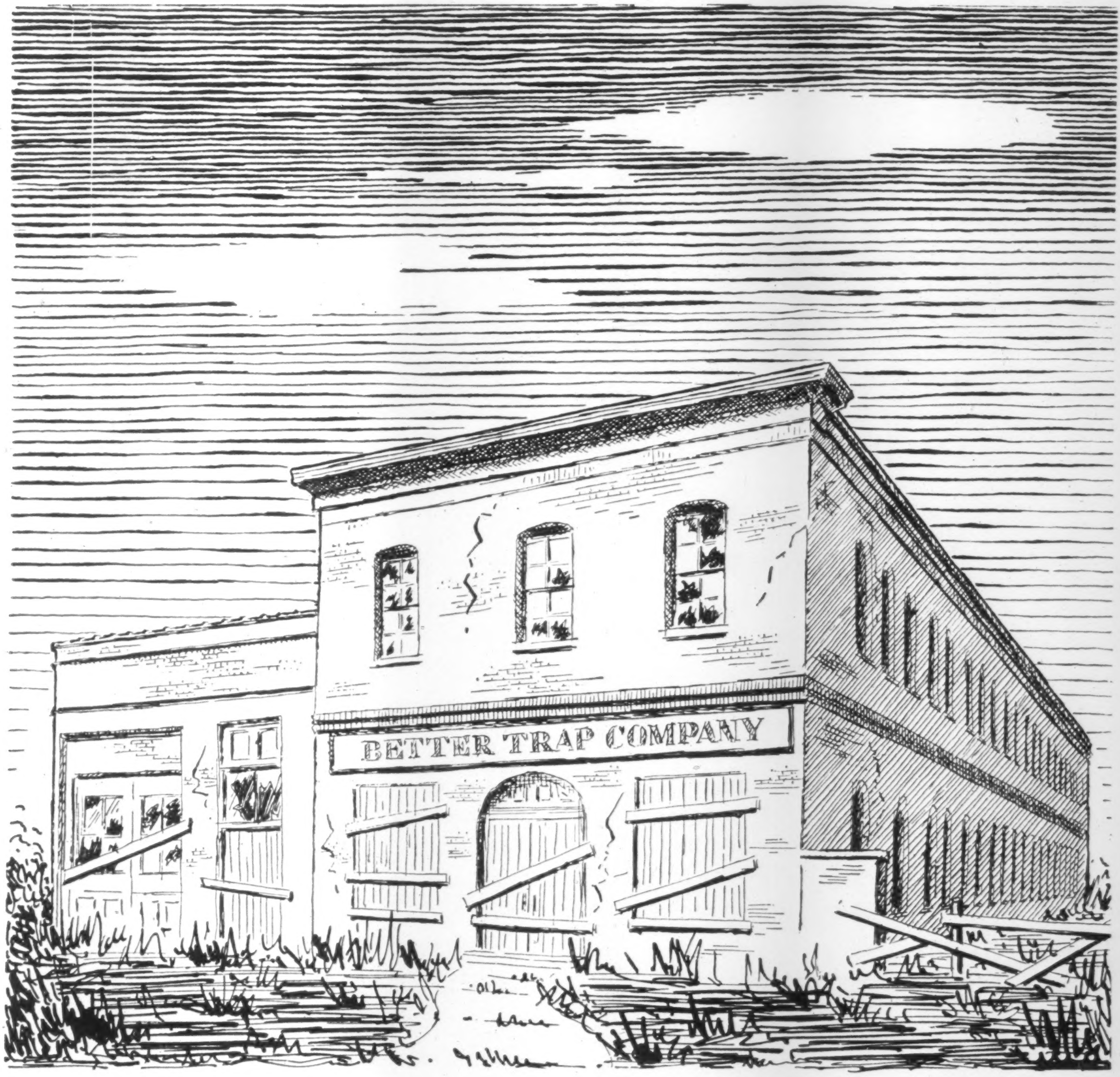
▶ Construction is underway in Massillon, Ohio, on a new plant building for *GRISCOM-RUSSELL CO.* The 100 × 120 ft structure will be on an acre of ground adjoining the present main plant of the company.

▶ More than 20 representatives of a dozen eastern area gas companies attended a full day series of meetings held in Reading, Pa., recently, for the purpose of spotlighting developments in gas fired boiler equipment. The meeting was sponsored by *ORR & SEMBOWER, INC.*

▶ A program for construction of industrial gas production facilities or expansion of present facilities at six locations in Alabama, California, Illinois, Puerto Rico and Venezuela has been announced by *NATIONAL CYLINDER GAS CO.* The program will bring to 78 the number of plants at which NCG produces one or more kinds of industrial gas.

▶ The newest addition to the *SIMPSON ELECTRIC CO.* group plants is nearing completion at Mercer, Wis. Production capacity of the facility will be be devoted primarily to meeting demands on the company's warehouse stock of panel instruments, according to the firm.

▶ The San Francisco office of *SARCO CO., INC.* and *SARCOTHERM CONTROLS, INC.* has moved to new and larger quarters at 1485 Bayshore Blvd., in that city. ⌗



MOUSETRAP, STEAM TRAP, SEWER TRAP

...it makes no difference

. . . the world *won't* beat a path to the door of the man who builds a better one *and then doesn't advertise it* so that people will know about his product, know where it can be bought and how much it costs.

Advertising benefits the buyer, too. It tells you the product story, makes it easy for you to buy. Even more important to you, advertising leads to mass production and volume sales . . . which means lower costs and lower prices.

Yes, "Advertising Benefits You" . . . 'specially business-paper advertising.

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Please send Velometer Bulletin 2448-G.

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Company...

Address...

City..............................Zone......State...................

MEETINGS & CONVENTIONS

MARCH 11-14—*National Warm Air Heating and Air Conditioning Association,* short course in heating and air conditioning. North Carolina State College, Raleigh. Information: Prof. R. B. Knight, Mechanical Engineering Dept., North Carolina State College, Raleigh.

MARCH 11-15—*National Association of Corrosion Engineers,* annual conference and exhibition. Kiel Auditorium, St. Louis. NACE headquarters: 1061 M&M Bldg., Houston 2.

MARCH 11-15—1957 *Nuclear Congress.* Convention Hall, Philadelphia. Information: Engineers Joint Council, 20 W. 39th St., New York 18.

MARCH 18-21—*Society of the Plastics Industry,* annual national conference and Pacific Coast plastics exposition. Hotel Biltmore and Shrine Exposition Hall, Los Angeles. SPI headquarters: 250 Park Ave., New York 17.

MARCH 25-29—*Hospital Engineering Institute and Workshop.* Antlers Hotel, Colorado Springs, Colo. Conducted by American Hospital Association, 18 E. Division St., Chicago 10.

MARCH 27-29—*19th Annual American Power Conference.* Hotel Sherman, Chicago. Information: Raymond D. Meade, Illinois Institute of Technology, 3300 S. Federal St., Chicago.

APRIL 2-4—*National Association of Corrosion Engineers,* corrosion control short course. Central Oklahoma section and University of Oklahoma, Norman. NACE headquarters: 1061 M & M Bldg., Houston 2.

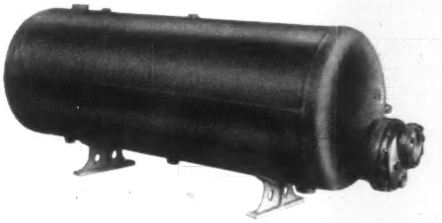
APRIL 3-5—*Government-Industry Symposium on General Air Conditioning Applications.* U.S. Department of Commerce, Washington, D.C. Information: Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W., Washington 6, D.C.

APRIL 8-12—*American Welding Society,* national spring meeting. Hotel Sheraton, Philadelphia. To be held in conjunction with the Fifth Welding and Allied Industry Exposition. Convention Hall, Philadelphia. Information: American Welding Society, 33 W. 39th St., New York 18.

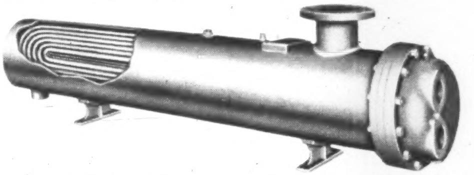
APRIL 10-12—*National Nuclear Instrumentation Conference* and *Third Southeastern Exhibit.* Atlanta.

Whitlock

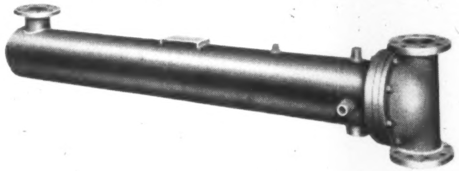
WATER HEATERS FOR EVERY SERVICE



STORAGE HEATERS Whitlock Type K Storage Heaters provide adequate supplies of hot water at all times. Everdur construction assures lifetime service: made also in Eterno and Standard Steel. A wide range of sizes for every requirement. Bulletin 40B.



INSTANTANEOUS HEATERS Whitlock Type R Instantaneous Heaters are used where hot water at a nearly uniform rate is desired. The U-tube bundle is removable. Other designs also available. Bulletin 20A.



CONVERTORS Whitlock Type R Convertors are widely used for space heating systems in all types of buildings. The two-pass design furnishes hot water with minimum pressure drop. Made in a full range of sizes, for typical pressure. Bulletin 62.

Whitlock Water Heaters are widely used in hospitals, laundries, mills, hotels, schools, and industrial plants . . . large and small . . . where their record of performance is outstanding. We have standardized heaters ideally suited for the majority of applications, and also design and build water heaters to meet special needs. We will gladly assist you with any water heating problems . . . ask us for suggestions or illustrated bulletins.

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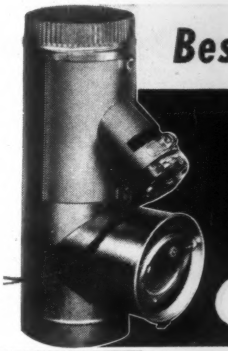

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draft inducer to correct for lack of natural draft.

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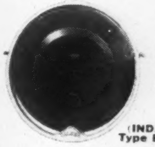
Automatic Draft Controls

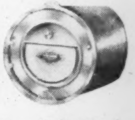
When it comes time to recommend, specify, buy or install draft control equipment for small space heaters or your biggest commercial installation, look first to Walker, world's largest factory devoted exclusively to the manufacture of automatic draft controls. Over 25,000,000 now sold for coal, oil, and gas prove Walker Controls are the best you can buy for quality, dependability, and fuel-saving performance.

Type Z

Type 34B



(IND.) Type BB



Walker Royal Purple Model

WALKER A Complete Line of Draft Control Products

Walker Draft Controls, available in 3" to 48" sizes, help keep chimneys dry, stop pulsation and smoking, eliminate soot and odors; give trouble-free performance even under most adverse conditions. Walker Controls are made with perfect balance. Knife-edge bearings are incorporated into the inner side of sturdy frame. Underwriter Approved.

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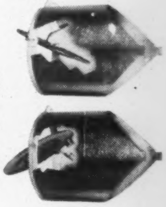
BBG DOUBLE SWING CONTROL



Walker's BBG Double Swing Control regulates updraft, dissipates downdraft in gas-fired equipment. Unique relief bar arrangement for flawless performance. Stainless steel knife-edge bearings. Corrosion resistant. Long, heavy gauge collar holds the draft control safely out of the flue gas stream.

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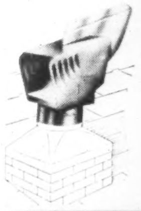
VENTURI-TOP CHIMNEY TOP



For heating (gas, oil, or coal) and ventilating. Directional vane keeps throat facing wind. Sloping-throat prevents back drafts, intensifies air flow over chimney opening for maximum draft effectiveness. Unit rotates on friction-free, hardened-steel ball bearing.

WALKER *30 Years of Draft Control Experience!*

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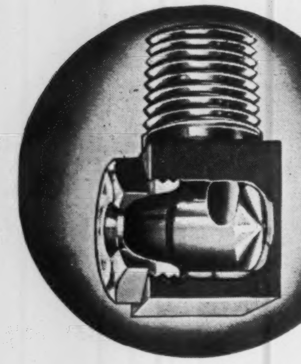

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NOZZLES for AIR WASHERS

These are "non-clogging" nozzles with a single large tangential lead hole to the swirl chamber that will never clog from any impurities small enough to pass through the orifice. Swirl chamber is conical on both ends and pivots liquid like a top to produce an exceptionally fine, evenly distributed, balanced spray of about 80° included angle. Wider spray angles up to 130° can be furnished to order.
Standard material Brass. Also available in Stainless Steel and Monel. Pipe sizes from 1/8" to 1". 1/4" size is 1-5/16" long and made from 5/8" square stock.

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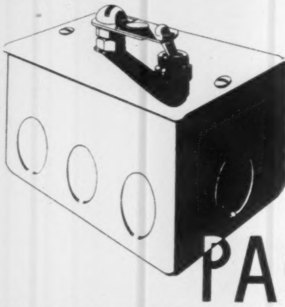

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MEETINGS & CONVENTIONS

Continued

Information: Herbert Kindler, Instrument Society of America, 313 Sixth Ave., Pittsburgh 22.

APRIL 14-27—*United States World Trade Fair.* Coliseum, New York. Information: United States World Trade Fair, 331 Madison Ave., New York.

APRIL 15-17—*Building Research Institute,* annual meeting. Edgewater Beach Hotel, Chicago. BRI headquarters: 2101 Constitution Ave., Washington 25, D.C.

APRIL 15-17—*Oil-Heat Institute of America, Inc.,* third annual commercial-industrial oil burning and equipment conference. New York University, New York City. OHI headquarters: 500 Fifth Ave., New York.

APRIL 23-24—*Third Biennial Conference on Electric-Heating.* Commodore Perry Hotel, Toledo. Sponsored by American Institute of Electrical Engineers and Toledo Section of AIEE. Information: AIEE, 33 W. 39th St., New York 18.

MAY 1-2—*National Warm Air Heating and Air Conditioning Association,* second annual technical conference. Hotel Cleveland, Cleveland. NWAHACA headquarters: 640 Engineers Bldg., Cleveland 14.

MAY 3—*Fourth Annual Conference for Engineers and Architects.* Ohio State University. Sponsored by College of Engineering, Ohio State University, Columbus.

MAY 3-7—*Western Air Conditioning, Heating, Ventilating and Refrigeration Conference and Exhibit.* Shrine Exposition Hall, Los Angeles. Information: Fred J. Tabery, 3443 S. Hill St., Los Angeles.

MAY 6-8—*Air-Conditioning and Refrigeration Institute,* annual meeting. The Homestead, Hot Springs, Va. ARI headquarters: 1346 Connecticut Ave., N. W., Washington 6, D.C.

MAY 7-10—*Mechanical Contractors Association of America,* annual meeting. Hotel Fontainebleau, Miami Beach. The association is at 30 Rockefeller Plaza, New York 20.

MAY 8-11—*Fluid Control Institute, Inc.* The Greenbriar, White Sulphur Springs, W.Va. Information: Fluid Control Institute, Inc., P.O. Box 191, Decatur, Ill.

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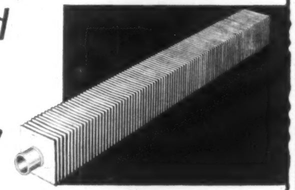

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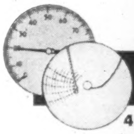

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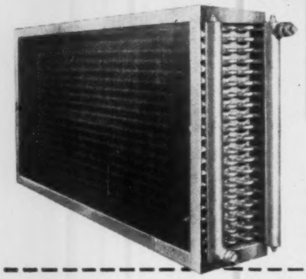

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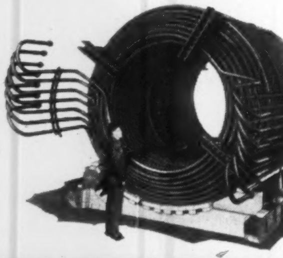

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Founded 1890

REMPE COMPANY
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Chicago 12, Illinois

MEETINGS & CONVENTIONS

Continued

MAY 14-16—Industrial Nuclear Technology Conference. Museum of Science and Industry, Chicago. Information: Dr. Leonard Reiffel, Armour Research Foundation, Illinois Institute of Technology, 10 W. 35th St., Chicago 16.

MAY 20-22—National Association of Corrosion Engineers, northeast region corrosion control conference. Syracuse University, Syracuse, N.Y. NACE headquarters: 1061 M & M Bldg., Houston 2.

MAY 20-23—Design Engineering Show. Coliseum, New York. Management: Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

MAY 20-24—National Fire Protection Association, annual meeting. Hotel Statler, Los Angeles. NFPA headquarters: 60 Batterymarch St., Boston.

JUNE 2-5—American Society of Refrigerating Engineers, annual meeting. Hotel Fontainebleau, Miami Beach. ASRE headquarters: 234 Fifth Ave., New York.

JUNE 3-6—National District Heating Association, 44th annual meeting. The Homestead, Hot Springs, Va. Information: John F. Collins, Jr., secretary-treasurer, NDHA, 827 N. Euclid Ave., Pittsburgh.

JUNE 3-7—Oil-Heat Institute of America, Inc., 35th annual convention. Sheraton-Plaza Hotel, Boston. OHI headquarters: 500 Fifth Ave., New York 36.

JUNE 5-7—National Warm Air Heating and Air Conditioning Association, West Coast summer convention. Fairmont Hotel, San Francisco. NWAHACA headquarters: 640 Engineers Bldg., Cleveland 14.

JUNE 11-13—Third Western Plant Maintenance and Engineering Show. Civic Auditorium, San Francisco. Management: Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

JUNE 16-21—American Society for Testing Materials. Chalfonte-Haddon Hall, Atlantic City. ASTM headquarters: 1916 Race St., Philadelphia 3.

JUNE 24-27—American Society of Heating and Air-Conditioning Engineers, Inc., semi-annual meeting. Manoir Richelieu, Murray Bay, Quebec. Information: A. V. Hutchinson, executive secretary, ASHAE, 62 Worth St., New York 13.

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MEETINGS & CONVENTIONS

Continued

AUG. 11-15—*First National Conference on Applied Heat Transfer.* Pennsylvania State University, University Park, Pa. Sponsored by heat transfer division and central Pennsylvania section of American Society of Mechanical Engineers in cooperation with College of Engineering and Architecture of the University. ASME headquarters: 29 W. 39th St., New York 18.

SEPT. 9-13—*12th Annual Instrument Automation Conference and Exhibit.* Cleveland Auditorium, Cleveland. Sponsored by Instrument Society of America, 313 Sixth Ave., Pittsburgh 22. Exhibit information: Fred J. Tabery, 3443 S. Hill St., Los Angeles.

SEPT. 18-20—*Insulation Distributor-Contractors National Association, Inc.*, second annual convention. St. Francis Hotel, San Francisco. Information: IDCNA, 1632 K St., N.W., Washington, D.C.

OCT. 6-8—*Fluid Control Institute.* Westchester Country Club, Rye, N.Y. Information: Fluid Control Institute, Inc., P.O. Box 191, Decatur, Ill.

OCT. 7-9—*American Gas Association*, annual convention. Kiel Auditorium, St. Louis. AGA headquarters: 420 Lexington Ave., New York 17.

NOV. 13-14—*Air Pollution Conference.* Chicago. Cosponsored by Armour Research Foundation and Midwestern Air Pollution Prevention Association. Information: Conference secretary, Armour Research Foundation, 10 W. 35th St., Chicago 16.

NOV. 14-16—*American Society of Refrigerating Engineers*, semi-annual meeting. Morrison Hotel, Chicago. ASRE headquarters: 234 Fifth Ave., New York.

NOV. 18-21—*10th Exposition of the Air-Conditioning and Refrigeration Industry.* International Amphitheater, Chicago. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington 6, D.C.

NOV. 18-22—*National Warm Air Heating and Air Conditioning Association*, committee meetings and annual convention. Morrison Hotel, Chicago. NWAHACA headquarters: 640 Engineers Bldg., Cleveland 14.

JAN. 27-29, 1958—*American Society of Heating and Air-Conditioning Engineers, Inc.*, 64th annual meeting. Pittsburgh. Information: A. V. Hutchinson, executive secretary, ASHAE, 62 Worth St., New York 13. ‡

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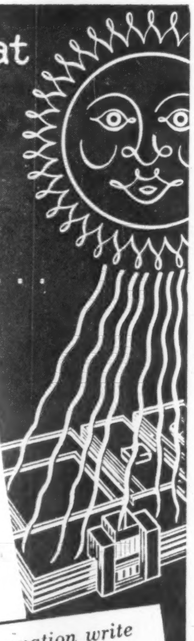

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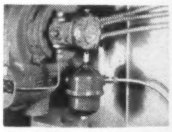

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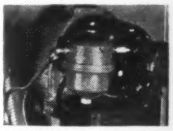

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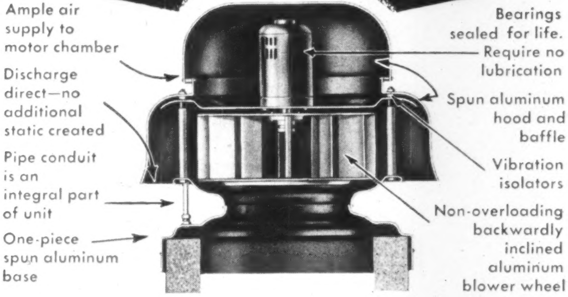
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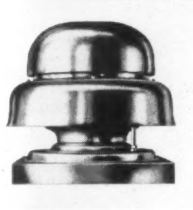

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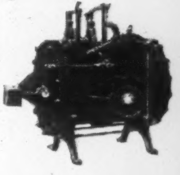

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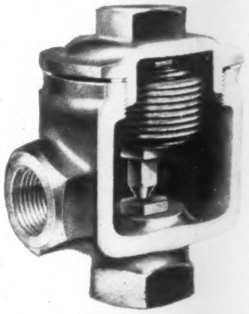

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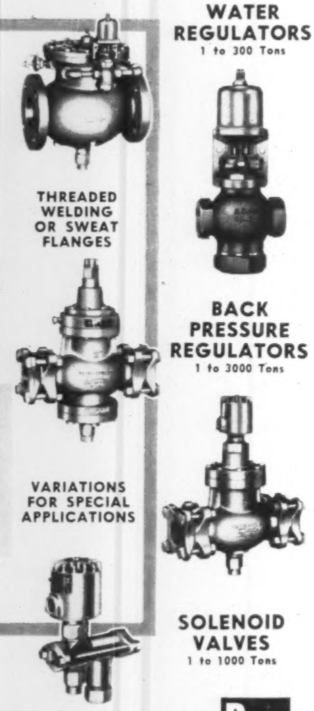

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Boiler and Unfired Pressure Vessel Code—Revised Ed. 58 pp. Wisconsin Administrative Code of Industrial Commission. Issued by Industrial Commission of Wisconsin, State Office Bldg., Madison 2, Wis.

Journal of Solar Energy Science and Engineering—64 pp. Association for Applied Solar Energy, 3424 N. Central Ave., Phoenix. $3.00.

Pump Selection and Application—By Tyler G. Hicks. 432 pp. McGraw-Hill Book Co., Inc., Industrial and Business Book Information Service, 327 W. 41st St., New York 36. $8.50.

1956 Supplements to Book of ASTM Standards—In seven parts: Part 1—ferrous metals, 440 pp.; Part 2—nonferrous metals, 360 pp.; Part 3—cement, concrete, ceramics, thermal insulation, road materials, waterproofing and soils, 300 pp.; Part 4—paint, naval stores, woods, sandwich construction, building constructions, fire tests, and wax polishes, 230 pp.; Part 5—fuels, petroleum, aromatic hydrocarbons, and engine antifreezes, 320 pp.; Part 6—rubber, plastics, and electrical insulation materials, 380 pp.; Part 7—textiles, soap, water, paper, adhesives, shipping containers, and atmospheric analysis, 220 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3. $4.00 per part; $28.00 per set.

Engineering as a Career—By Ralph J. Smith. 365 pp. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36. $4.75.

Tinplate Handbook—Third Ed. By W. E. Hoare. 44 pp. Tin Research Institute, Inc., 492 W. Sixth Ave., Columbus 1, Ohio. Free.

Acceptance Test Procedure For Industrial Water-Cooling Towers, Mechanical Draft Type—4 pp. Bulletin ATP-105, Cooling Tower Institute, 446 Emerson St., Palo Alto, Calif. $1.00.

National Standards in a Modern Economy—372 pp. American Standards Association, 70 E. 45th St., New York. $5.00.

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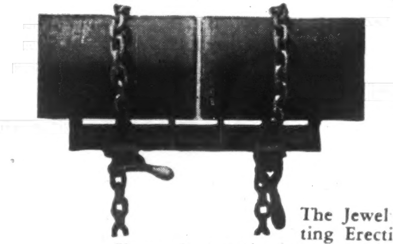

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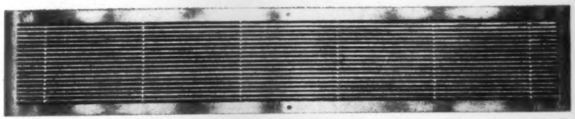

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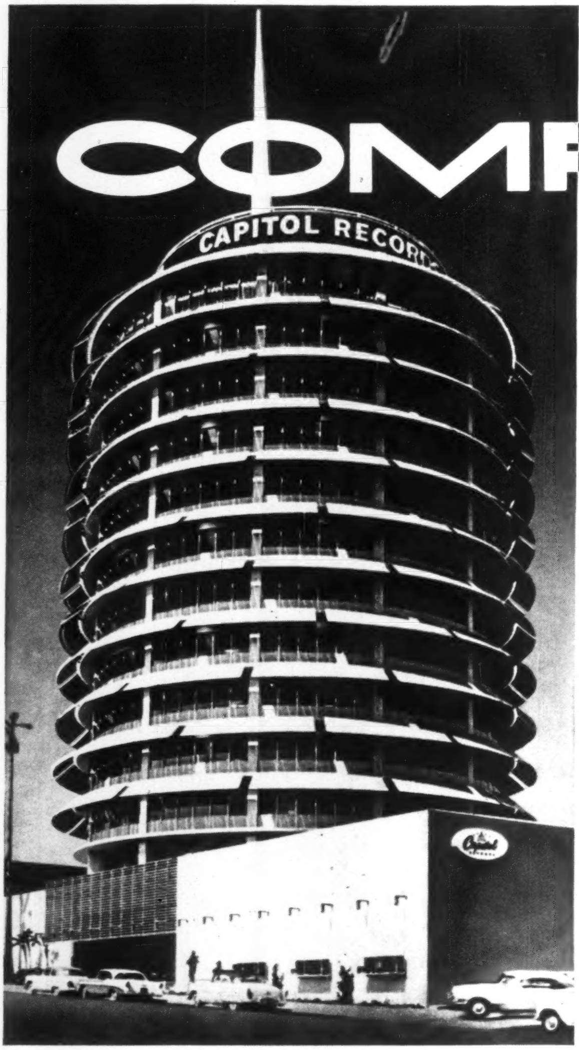

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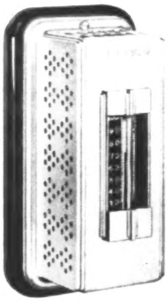

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